POSTER SESSION 1

Atrial fibrillation

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Effects of pioglitazone on atrial ionic channel remodeling in diabetic rabbits hearts

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Objective: We investigated the effects of pioglitazone on atrial ionic channel remodeling in alloxan-induced diabetic rabbits, and electrophysiological mechanisn of pioglitazone on atrial fibrillation.
Methods: 32 rabbits were divided into CN group, DM group, DPG group and DPI group. Langendorff-perfused rabbit hearts were used to isolate single atrial myotcyte, and whole-cell patch-clamp technique was used to record action potential duration (AP) and atrial ionic channel currents (ICa,L and INa).
Results: Compared with controls, APD90 and APD50 of left atrial myocytes were significantly prolonged in DM group ($P < 0.05$ vs. CN), and APD90 rate adaptation was no significant differences ($P > 0.05$ vs. CN). The densities of INa were reduced and the densities of ICa,L were increased in DM group ($P < 0.01$ vs. CN). The above were markly attenuated in DPG and DPI group.
Conclusion: Pioglitazone may prevent atrial ionic channel remodeling in diabetic rabbits, even play an important prevention to DM-related AF.

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Adjunctive dose of oral flecainide or propafenone in acute management of atrial fibrillation patients on top 1 C antiarrhythmic drug therapy

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The management of atrial fibrillation (AF) in patient on chronic antiarrhytmic therapy, with arrhythmia recurrences is a common clinical problem.
Besides the initial therapy after onset of AF should always include adequate antithrombotic treatment and control of ventricular rate, an early rhythm control is a valid opportunity in particular in symptomatic and young patients [1,2].
With this strategy not only we can treat the clinical problem , but we prevent the worsening of the disease that can flow into persistent atrial fibrillation related to many electrical and anatomical changes and it 's more difficult to defeat.
Now because many people are in treatment with antiarrhythmic drugs to maintain sinus rhythm, it rises the problem of rhythm control of symtomatic atrial fibrillation recurrences in this setting. In literature data about this matter are few.
96 of 100 consecutive patients admitted for recurrence paroxysmal AF, in chronic therapy with Propafenone (PNF) or flecainide (FL) , were randomised to a further oral adjunctive dose of the same drug taken chronically (Flecainide treatment 100 mg [FL- T] and PNF tretament 300 mg [PNF-T]) or to a clinical observation.
Sinus rhythm restoration was observed in 15/26 PNF – T patients 58%, in 17/24 FL-T patients (72%) ($p = 0,05$), in 7/21 flecainide group control (FL – C) and 5/25 propafenone group control (PNF-C) 21% ($p = 0.001$); the therapeutical goal was reached faster in FL-T (Group PNF- T 6 ± 2,9 hours vs FL – T 3 ± 0,5 hours, $p = 0,05$).
Atrial flutter ≥ 2:1 was observed in 5/26 (21%) PNF – T and in 7/24 (28%) FL-T.
Sinus pauses (< 2 sec) were observed in 6/26 PNF-T (2%) and in 4/24 FL – T (15%) patients at the time of sinus rhythm restoration. None of the patients presnted an AFL 1:1 atrio ventricular conduction.
In patients with recurrence of AF, on top class IC agents for rhythm control, a further adjunctive oral dose of propafenone or flecainide can be safe and successful in restoring sinus rhythm.

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Comparing the efficacy, hospitalization time and safety of vernakalant to propafenone in recent-onset atrial fibrillation in the emergency department

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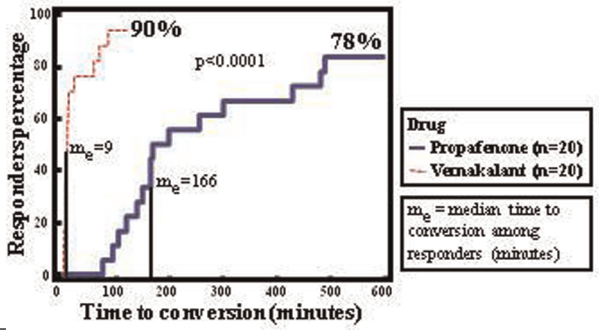
Purpose: Intravenous Vernakalant (V) has effectively converted Recent-Onset Atrial Fibrillation (ROAF) to Sinus Rhythm (SR) and demonstrated superior effectiveness to placebo and intravenous amiodarone. The objective of this study was to compare the efficacy, Hospitalization Time (HT) and safety of V and oral loading dose of Propafenone (Pr) for the acute conversion of ROAF to SR in the Emergency Department (ED).
Methods: A total of 40 adult patients (P) with AF (3 to 48 hours duration) eligible for cardioversion with Pr were enrolled. P received either a 10-minutes infusion of V (3 mg/kg), followed by a 15-minutes observation period, and a second 10-minutes infusion (2 mg/kg) if still in AF (n = 20), or an Pr with 600 mg (n = 20). Efficacy end point was the conversion of AF to SR within 90 minutes of first exposure to the study drug.
Results: Conversion from AF to SR within the first 90 minutes was achieved in 18 of 20 V P compared with 1 of 20 Pr P ($p < 0.0001$). The median time to conversion from AF to SR in P who received V was 9 (6-18) minutes and 166 (120-300) minutes in P who received Pr ($p < 0.0001$). The median HT was 238 (189.7-277.7) minutes in V group and 416 (336.7-740.5) minutes in Pr group ($p < 0.0001$). There were no serious adverse events.
Conclusions: Intravenous vernakalant demonstrated superior efficacy to oral loading dose of propafenone for acute conversion of ROAF and a shorter HT in the ED. Both were safe and well tolerated.



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Clinical and procedural features associated with high risk of multiple procedures to achieve PAF ablation

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Introduction: Catheter ablation of paroxysmal AF has proven efficacy and safety. However, more than 20% of patients require more than one procedure to obtain clinical success. We aimed to identify groups of patients associated with higher risk of AF recurrence after PAF ablation.
Methods: All patients referred for catheter ablation of PAF (<7 days) in our institution were included in the study. All patients had lasso-guided PVI, additional LA substrate ablation (complex fractionated electrogram (CFE), linear ablation) was performed if spontaneous or induced AF was sustained after PVI. Follow-up visit were performed at 1, 3, 6 and 12 months with clinical evaluation, TTE, 24 holter monitoring. Recurrence was defined by more than 30sec of documented AF or typical symptoms of palpitation. We used uni- and multivariable models to identify predictors of AF recurrence over 12 months follow-up.
Results: A total of 338 Pts (55 ± 11 yrs, 25% females) underwent a first ablation for PAF between 2004 and 2010. Median longest reported AF episode was 12 hours, range 1 to 168H. After 11 ± 2 mo., 78% of pts were free of AF after a mean of 1.5 ± 0.8 procedures. After single procedure, criteria associated with recurrences were: female gender ($p < 0.0001$), hypertension ($p = 0.009$), longest episode > 24H ($p = 0.05$). Patients with longest episode ≤ 24h had more chance to obtain success after 1 procedure (0R= 1.9).
Conclusion: In PAF ablation longest episode of AF > 24h, hypertension, and female gender are associated with higher risk of AF recurrence.

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Progression of atrial fibrillation and clinical correlates in patients hospitalized for systolic heart failure

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Background: Development of atrial fibrillation (AF) in patients (pts) with congestive heart failure (HF) remains one of the leading causes of clinical deterioration.Furthermore a rhythm control strategy has not been shown to improve long term outcomes in AF pts.
Study: We conducted a study on 90 pts hospitalized for HF and new onset AF from January 2009 through December 2012. Onset date of AF was determined retrospectively and assigned to the date when AF was first documented by electrocardiogram. Mean age was 73 (±14) years, 44% women ,mean ejection fraction 39% (±9). Rhythm control strategy was randomly attempted in Day Hospital 4 weeks after hospital discharge. Almost all patients during hospitalization and after discharge received amiodarone, β-blockers, spironolactone (MRA), angiotensin-converting-enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB), diuretics, warfarin . In the group not treated with EC amiodarone was stopped after 4 weeks.
Ischemic etiology was present in 22.2%, hypertensive cardiopathy in 57.7%, idiopathic cardiomyopathy in 18%; mean left atrium size was 55 mm(±7). Patients' medical records and electrocardiograms were reviewed and data were collected for all clinic visits through December 2012. Patients were considered to be permanently in atrial fibrillation when sinus rhythm was subsequently after discharge never recorded. The proportion of patients who remained free of progression to permanent atrial fibrillation was calculated.
Results: During the follow up 42 pts had developed permanent AF (46.6% of entire group): 21% of pts treated with EC versus 51% not receiving EC.
Pts treated with EC had a significant reduction in rehospitalization for HF : 22% versus 42%.
Conclusions: Rhythm control with EC may be beneficial in pts with heart failure and first documented AF.
Recurrence of AF may not define failure of the therapy in this setting because frequency, duration and severity of recurrences must all be considered in the contest of the pattern of HF and respect to the patient's quality of life.

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Lipid peroxidation disorders in patients with recent-onset atrial fibrillation

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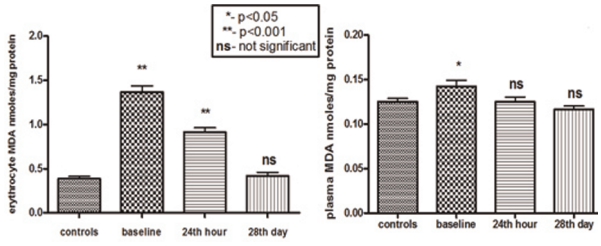
Purpose: To study malondialdehyde (MDA) as an indicator of lipid peroxidation in patients with recent-onset (< 48 hours) atrial fibrillation (AF) without structural heart diseases.
Methods: Blood samples were collected from 51 consecutive patients (mean age 59.8 ± 1.6 years, 26 males). MDA in plasma (P-MDA) and erythrocytes (Er-MDA) were measured at baseline prior to medical treatment, on 24th hour and 28th day after sinus rhythm (SR) restoration. In the study 52 healthy controls (mean age 59.5 ± 1.5 years, 26 males) were also enrolled matched by gender and sex to patients. The arrhythmia was treated with propafenone in all patients.
Results: Most patients were hospitalized on 5th hour after the onset of arrhythmia. The mean duration of AF episodes was 8.1 hours (from 2 to 24 hours). At baseline both P-MDA and Er-MDA in patients with AF were substantially increased (0.143 ± 0.007 vs 0.125 ± 0.004 nmoles/mg pr, $p < 0.05$; 1.368 ± 0.069 vs 0.386 ± 0.027 nmoles/mg pr, $p < 0.001$ respectively) as compared to the controls. On the 24th hour after SR restoration Er-MDA values were still elevated (0.916 ± 0.047 vs 0.386 ± 0.027 nmoles/mg pr, $p < 0.001$; P-MDA - 0.125 ± 0.005 vs 0.125 ± 0.004 nmoles/mg pr, $p > 0.05$). 28 days after the arrhythmia termination, no significant difference was established in P-MDA and Er-MDA concentrations in the patients and controls (0.117 ± 0.004 vs 0.125 ± 0.004 nmoles/mg pr, $p > 0.05$; 0.419 ± 0.039 vs 0.386 ± 0.027 nmoles/mg pr, $p > 0.05$).
Conclusions: Increased values of Er-MDA and P-MDA in patients with recent-onset AF and structurally normal hearts allow us to assume that an enhanced process of lipid peroxidation is present. We suppose that it may be closely related both to the onset of the disease and to its medical treatment.



P200

Clinical implications of and factors influencing spontaneous activities in dissociated pulmonary veins

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Introduction: Factors influencing spontaneous activities (SAs) in the pulmonary veins (PVs) in atrial fibrillation (AF) patients undergoing circumferential PV isolation have not been investigated. Furthermore, the clinical implications of such SAs remain controversial.
Methods and results: Circumferential PV isolation as a first ablation procedure was performed in 689 consecutive patients with AF (460 men; mean age, 58.9 ± 10.5 years). Acute PV isolation was achieved in 680 (98.7%) patients. A total of 579 (42.6%) ipsilateral PVs with SAs were documented in 379 (55.7%) patients (SAs group). Multivariate analysis revealed that male gender (Exp[B], 1.901; 95% confidence interval [CI]: 1.349–2.674; $P < 0.001$) and paroxysmal AF (Exp[B], 1.761; 95% CI: 1.215–2.551; $P = 0.003$) were independent factors for SAs. The incidence of acute and intraoperative PV reconnection (PVR) was higher in the SAs group than in the control group (33.0% vs. 17.9%, $P < 0.001$ and 44.3% vs. 28.2%, $P < 0.001$, respectively). After the first procedure, 244 (65.4%) SAs-group patients and 168 (56.4%, $P = 0.017$) control-group patients were free from AF recurrence. During repeat procedures, PVR incidence was similar in the SAs group (81.8%, 27/33) and control groups (83.3%, 35/42; $P = 0.863$).
Conclusion: Male gender and paroxysmal AF were independent risk factors for SAs in patients undergoing circumferential PV isolation. SAs had a significant impact on acute and intraoperative PVR but not on chronic PVR. The outcomes of the first ablation procedure were better in patients with SAs.

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Quantitative assessment of a new generation cryoballoon ablation catheter with new cooling technology

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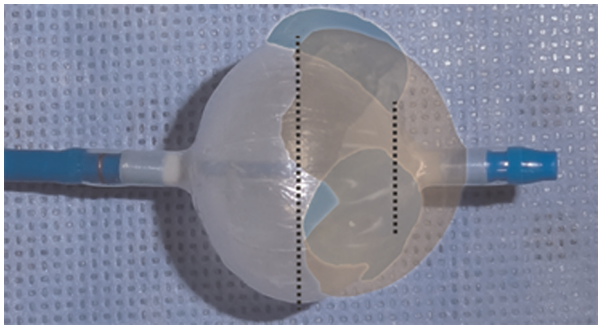
Purpose: Despite being engineered as a simple device for isolation of the pulmonary veins, the first generation cryoballoon (CB) had heterogeneous cooling behavior resulting in non-uniform temperature distribution. Recently, the novel CB generation has been released with improved cooling technology but the changes have not yet been quantified independently.
Methods: We submerged 3 first (Arctic Front) and 3 new generation (Arctic Front advanced) 28mm CB catheters, in a 37°C warm water bath for 300 s and 240 s, respectively. Pictures of the CB catheters with the resulting ice caps were taken, the covered surface area quantified and compared. Thawing behavior was compared by measuring the time until complete dissolving of the ice cap after termination of the freezing cycle. Theoretical, in silico reflections on various left atrial anatomies were performed to identify and compare improvements and risks.
Results: Ice caps covered 90% of the anterior half-sphere of the new generation CB, whereas the first generation CB catheter showed an inhomogeneous distribution with 4 small ice caps, resulting in coverage of less than 40% of the anterior half-sphere (Figure). The dissolving of the ice caps with a maximum thickness of 3.2 mm on the first generation CB lasted < 15 seconds in all cases. In contrast, the ice cap on the new generation CB had a maximum thickness of 5.0 mm and dissolving lasted more than 25 s in all cases.
Conclusions: The new generation CB showed more powerful and homogeneous cooling-behavior, especially at the pole of the balloon. The impact of the longer dissolving duration of the ice cap of the new generation CB on procedural safety needs to be investigated.



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Perimitral atrial flutter ablation by transaortic radiofrequency application

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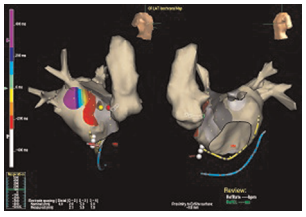
Purpose: Ablation of perimitral atrial flutter (PM-AFL) is performed by linear RF application from the mitral annulus to a pulmonary vein. This procedure is often challenging due to the difficulty to achieve transmural lesion all along the ablation line. We report a 71 year-old female with mitral prosthesis and incessant PM-AFL, who had undergone 2 previous initially successful ablation attempts.
Methods: The diagnosis of PM-AFL was established (370 ms). Voltage mapping showed a large anterior scar and both electranatomical post-pacing interval (Figure) and activation mapping found the conduction gap in the middle of the ablation line performed from the mitral annulus to the right superior pulmonary vein during the first ablation procedure and which was the same gap that that one found and ablated during the first and second procedures.
Results: A second irrigated tip ablation catheter was introduced through the aorta and positioned on the wall of the non-coronary cusp (NNC) just in front of the first ablation catheter positioned at the conduction gap. RF application (50 W) at the NNC lead to flutter termination. Ablation was completed with additional RF application from the other catheter located on the LA anterior wall. PM-AFL was no longer inducible and bidirectional conduction block was demonstrated along the anterior line. The patient had no arrhythmia recurrences at 12 month of follow-up. RF application from the aorta has been described in patients with focal atrial and ventricular tachycardias. However, this has been never reported to complete linear ablation of macroreentrant tachycardias.
Conclusions: RF application from the aortic NNC may be needed to achieve transmurality of linear lesion created by endocardial RF application on the LA anterior wall.



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Low voltage areas in atrial fibrillation do not correlate to LGE-MRI defined scar in patients with persistent atrial fibrillation

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Introduction: Late-gadolinium enhancement (LGE) cardiac magnetic resonance imaging (CMR) can detect pre-existing left atrial (LA) scar. Low voltage areas mapped in sinus rhythm (SR) have been shown to correlate with LGE-defined scar. We studied LGE-defined LA scar and the corresponding voltage in AF.
Methods: Ten patients with persistent AF underwent LGE-CMR prior to their ablation to obtain LA scar maps using our previously described validated automated method. Bipolar voltage mapping was performed in AF (point density 3.25 $\pm$ 1.1/cm2) and low voltage electrograms (LVE) were defined as <0.1mV. LA scar maps were registered with the LA geometry and areas with LGE >3SD above the mean blood pool intensity (LGE-scar) were outlined. Voltage maps were registered to LA scar map to identify overlapping segments.
Results: LGE-scar was present in all patients, corresponding to an area of 17.3 $\pm$ 13.9cm2 accounting for 16.6 $\pm$ 13.0% of the total LA surface area. LVE accounted for 31.2 $\pm$ 31.3% of the total LA surface area. There was little correlation between areas of LGE-scar and LVE, with the area of overlap being only 3.0 $\pm$ 2.6 cm2 corresponding to 2.8 $\pm$ 2.5% of the total LA surface area. 3,360 points were exported and no significant correlation (Pearson's) was found between the bipolar voltage and intensity of LGE at its corresponding LA surface point at the Bonferroni corrected significance threshold $p < 0.05/10$. There was no correlation between voltages and LGE intensity levels from SD 0 to 3.
Conclusions: Unlike in SR, LA endocardial voltages in AF do not correlate to LGE-defined LA scar in patients with persistent AF. This may reflect a distinct electrophysiological phenomenon as a result of functional electrical changes in AF.

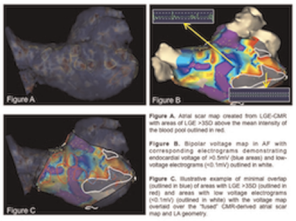

Figure A. Atrial scar map created from LGE-CMR with areas of LGE >3SD above the mean intensity of the blood pool outlined in red.

Figure B. Bipolar voltage map in AF with corresponding electrograms demonstrating endocardial voltage of <0.1mV (blue areas) and low-voltage electrograms (<0.1mV) outlined in white.

Figure C. Illustrative example of minimal overlap (outlined in blue) of areas with LGE >3SD (outlined in red) and areas with low voltage electrograms (<0.1mV) (outlined in white) with the voltage map overlaid over the "fused" CMR-derived atrial scar map and LA geometry.

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Biomarkers of myocardial injury with different energy sources for atrial fibrillation catheter ablation

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Introduction: Our study aims to compare acute myocardial injury biomarker rise after atrial fibrillation ablation performed with different technologies.
Methods: One hundred and ten patients (pts) were treated with Pulmonary Vein (PV) isolation with 4 different technologies: open-irrigated tip RF catheter in 35 pts (Group A), cryoballoon in 35 pts (Group B), visually guided laser balloon in 20 pts (Group C), open-irrigated tip RF catheter with contact-force-sensing technology in 20 pts (Group D). Post-procedure samples of cardiac Troponin I (cTnI) and Creatinine Kinase-MB (CKMB) were collected at 19 $\pm$ 3 and 43 $\pm$ 3 hours after ablation.
Results: At the first postprocedural sample, cTnI and CK-MB levels were found elevated in all 110 pts with a median value of 2.09 ng/mL and 8.95 ng/mL respectively. Group B pts showed cTnI levels increased (6.21 $\pm$ 3.46 ng/mL) compared to the other groups (Group A 1.92 $\pm$ 1.04 ng/mL, Group C 1.62 $\pm$ 0.87 ng/mL, Group D 2.53 $\pm$ 1.93 ng/mL; $p < 0.001$). Also CK-MB levels resulted higher in cryoablation (35.87 $\pm$ 24.51 ng/mL) compared to other groups (Group A 6.20 $\pm$ 3.18 ng/mL, Group C 7.11 $\pm$ 2.20 ng/mL, and Group D 8.41 $\pm$ 5.04 ng/mL; $p < 0.001$). No significant correlation was observed between biomarkers levels and recurrence of AF at 1, 3, 6, 12 months of follow up.
Conclusions: Highest markers for myocardial injury were observed in cryoballon group. These results may reflect the role of protein denaturation and a different pattern release of biomarkers in these settings. The higher levels of cardiac biomarkers did not translate into a better outcome and its physiologic significance is unknown.

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Retinal microvascular changes and atrial fibrillation incidence: the ARIC Study

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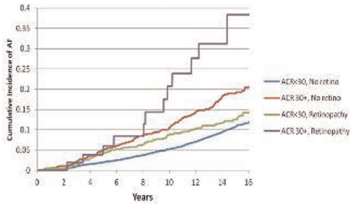
Background: Microvascular abnormalities seen in the retina and assessed in the kidneys as micro-albuminuria may be associated with microvascular abnormalities in coronary beds. Their relationship with atrial fibrillation (AF) remains unstudied.
Methods: We examined the association of retinopathy (alone and in combination with micro-albuminuria (>30mg/g)) with AF incidence in a biracial cohort of middle aged men and women.
Results: Of the 10009 study participants at baseline, 7.1% (n =711) had retinopathy (retinal hemorrhage 3%, retinal micro-aneurysms 4%) and 7.2% had micro-albuminuria. During an average follow up of 13.6 (3.7) years, 1100 participants had incident AF. AF incidence rates were 24.4, 16.8, 8.9, and 5.7 per 1000 person-years for those with retinopathy and micro-albuminuria, micro-albuminuria only, retinopathy only, and neither, respectively.
The age, race, and sex-adjusted hazard ratio (95% confidence intervals) of AF comparing those with retinopathy vs. those without was 1.86 (1.54-2.24). After additional adjustment for blood pressure, diabetes, other CV risk factors, and prevalent CVD, the HR was 1.37 (1.12-1.67). The association of retinal hemorrhage with AF in a model adjusted for covariates as above was 1.60 (1.23-2.07) and it was 1.47 (1.14-1.90) with retinal micro-aneurysms. Importantly, an additive interaction was seen between retinopathy and micro-albuminuria in relation to AF incidence (figure 1).
Conclusions: Signs of micro-vessel disease in retina and kidneys are independently and interactively associated with higher risk of AF. The mechanisms underlying the association are unclear but may include cardiac remodeling, endothelial dysfunction, autonomic dysfunction, and atrial fibrosis.



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Chronic atrial fibrillation is a risk factor for cognitive impairment?

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Introduction: Atrial fibrillation (AF), in addition to stroke, may also produce multiple cerebral ischemic areas due to microembolic phenomena and transient hypoperfusion, eventually leading to a progressive cognitive impairment.
Aims: To determine if atrial fibrillation (AF) in stroke-free patients is associated with cognitive impairment.
Methods: 218 patients with atrial fibrillation patients with non-valvular atrial fibrillation and no history of stroke, transient ischaemic attack were consecutively admitted. All cases underwent physical examination, blood chemistry, urinalysis, chest radiography ECG, Doppler echocardiography. To investigate the cognitive status, subjects underwent the neuro-psychological rating scale Mini Mental State Examination (MMSE).
Results: The 218 patients (mean age 70.1 ± 0.65 years; 59% W) were stratified according to ECG features into 3 groups: : (I) those with AF de novo (n = 6; 2.8%), (II) those with paroxysmal atrial fibrillation (ie, history of >1 episode of arrhythmia lasting <48 hours) (n = 40; 18.4%), and (III) those with chronic AF (ie, arrhythmia lasting >6 months) (n = 172; 78.9%). Cognitive status as assessed by MMSE was found to be significantly different in the 3 groups: group I- 28.1 ± 1.9; group II - 25.9 ± 2.9; and group III - 24.9 ± 2.9 (P < 0.01). The Table 1 shows the association of atrial fibrillation with cognitive impairment. In the group with cognitive impairment there were more older subjects (>65 years) - 73%, patients with sever heart failure, with ejection fraction < 40 % (63%), with arterial hypertension grade III (88%) and diabetes mellitus - 33%. The anticoagulation rate in these patients was 18%, with 8% on an optimal treatment level (INR 2.0-3.0).
In conclusion, chronic atrial fibrillation is a factor which correlate with low cognitive function. The use of anticoagulant therapy whenever is indicated might prevent not only major cerebrovascular accidents but also the less obvious clinical outcome of cognitive function loss.

Rhythm	Cognitive impairment (MMSE < 26) YES	NO	p
Novel AF (nr.6)	1 (16,6%)	5 (83,4%)	
Paroxysmal AF (nr.40)	10 (25%)	30 (75%)	<0,05
Chronic AF (nr.172)	90 (52,3%)	82 (47,7%)	

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Atrial fibrillation occurrence and clinical impact in heart failure patients treated with cardiac resynchronization therapy defibrillators

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Purpose: Atrial fibrillation (AF) is a frequent comorbidity in patients with heart failure and has been associated with compromised hemodynamics, heart rate irregularity, uncontrolled ventricular rate, quality of life and in general with a worse prognosis. Aim of our research was to assess the occurrence and clinical effects of AF in patients with implantable cardioverter defibrillators with cardiac resynchronization therapy (CRT-ICD).
Methods: 1404 CRT-ICD patients (1118 males, 67 ± 10 years) were prospectively followed up in 74 Italian cardiology centres. Device diagnostics allowed to detect AF occurrence and duration and its association with ventricular rate (VR), biventricular pacing and inappropriate ICD therapies. Clinical data, such as AF-related hospitalizations or interventions, were collected during in-hospital scheduled and unscheduled visits.
Results: AF history was present in 362 patients. In a median follow-up of 31 months AF lasting >10 minutes occurred in 556 patients, of whom 237 had AF history and 319 were new onset AF patients. AF was classified according to its duration in 5 AF profiles: 144 patients had AF lasting between 10 minutes and 6 hours, 88 patients between 6 hours and 1 day, 72 patients between 1 day and 7 days, 193 patients between 7 days and 6 months, and 59 patients suffered AF episodes longer than 6 months. AF caused 1) loss of biventricular pacing, defined as a pacing percentage <95%, in 400/556 (72%) patients, 2) uncontrolled VR during AF, defined as mean VR > 80 bpm and a maximum VR > 110 bpm, in 189/556 (34%) patients and 3) inappropriate ICD shocks in 60/556 (11%) patients. AF caused unscheduled in-hospital visits in 116/556 (21%) patients; in 37/116 (32%) patients were hospitalized and 31/116 (27%) were treated by pharmacological or electrical cardioversion, AV node ablation of pulmonary veins ablation.
Conclusions: AF is a common occurrence in CRT-ICD patients and causes uncontrolled ventricular rate, loss of biventricular pacing and inappropriate ICD shocks in a consistent portion of patients leading to an important health care resource utilization.

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The effects of eosinophil on the left atrial thrombus in patients with atrial fibrillation

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Background: Atrial fibrillation (AF) is the most common cardiac rhythm disorder. AF causes a 5-fold increased risk for thromboembolic stroke . It is known that eosinophils play an important role in thrombosis. We aimed to compare the numbers of eosinophil counts of the patients with and without thrombi in the left atrium (LA) or in the left atrial appendage (LAA) and to ascertain the association of eosinophil counts with the presence of thrombi.
Method: The study included 84 patients were diagnosed with persistent AF who were performed transesophageal echocardiography and designated to be undergone cardioversion. The patients were divided into two groups; the group 1 consisted of 40 patients (18 male; average age 63.27 ± 1.4) who had thrombus formation in the LA or LAA, and the group 2 consisted of 49 patients (23 male; average age 66.53 ± 1.56) who did not have any thrombus in the LA or LAA. These patients were performed concurrent routine biochemical tests and eosinophil count on whole blood count.
Results: Baseline characteristics of the study groups were comparable. Group I patients had a higher eosinophil and MPV value than group II (233.0 ± 30.7 vs 118.9 ± 11.8 and 9.77 ± 0.20 vs 8.27 ± 0.12 fl p < 0.001. respectively). In group I the patients' left atrium (LA) diameter is higher than the group II.
Conclusion: As a result our study revealed a relationship between eosinophil count and LA thrombus in patient with nonvalvular AF.

	Group I (n=40)	Group II (n=49)	p
Fasting glucose (mg/dl)	92.5 ± 13.2	95.2 ± 14	0.423
Creatinin (mg/dl)	0.9 ± 0.3	0.8 ± 0.2	0.224
Hb (g/dL)	12.8 ± 0.240	12.7 ± 0.294	0.67
Wbc (10^3/μl)	9389 ± 574	8108 ± 320	<0.001
Eosinophil count(10^3/μl)	233.0 ± 30.7	118.9 ± 11.8	<0.001
MPV (fL)	9.77 ± 0.20	8.27 ± 0.12	< 0.001
MCV (fL)	87.88 ± 0.77	87.04 ± 1.18	0.57
HTC (%)	38.22 ± 0.88	38.31 ± 0.71	0.93
Platelet (10^3/μl)	238.05 ± 12.44	219.12 ± 9.19	0.28

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The association of biomarkers of inflammation and neurohumoral activation with the progression of atrial fibrillation to permanent arrhythmia

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The Purpose of the present study was to determine the significance of biomarkers of inflammation (e.g. C-reactive protein, CRP) and neurohumoral activation (e.g. B-type natiuretic peptide, BNP) for the progression of atrial fibrillation (AF) from paroxysmal and persistent AF to permanent arrhythmia.
Methods: we prospectively enrolled 275 symptomatic AF pts with paroxysmal and persistent AF (mean age 63 ± 14 yrs, 58% men; parox. AF, n = 197; perist. AF, n = 88), without an acute myocardial infarction, heart failure or significant valvular disease. Rhythm control strategy was employed in accordance with the European Society of Cardiology clinical practice guidelines, which included the pharmacological or electrical cardioversion, as appropriate, and treatment with at least one antiarrhythmic agent and anticoagulation as indicated. Clinical and echocardiographic parameters and CRP and BNP levels were determined at baseline. Patients were regularly followed-up and AF recurrence (symptomatic or detected on regular control exams every 3 months) was notified. Development of permanent AF, defined as failure of all attempts at restoration and maintenance of sinus rhythm, was recorded.
Results: after a median 17-month follow-up (range 5-29 months) AF recurrence was detected in 107 pts (38.9%) and progression to permanent AF occurred in 32 pts (11.6%). Both CRP and BNP were associated with AF progression in the univariate analysis and optimal cut-off values to predict AF progression were determined. In the multivariate regression analysis, after adjustments for age, gender, prior AF duration, comorbidities, left atrial volume (LAV), left ventricular ejection fraction (LVEF), medications, creatinine clearance, smoking and alcohol consumption, baseline CRP had no independent prognostic significance for AF recurrence, while baseline BNP >548 pg/mL emerged as an independent predictor of permanent AF development (HR = 2.48, 95%CI 1.06-3.78, P = 0.008).
Conclusions: the present study has demonstrated that CRP has no independent prognostic value for AF progression to permanent arrhythmia. On the other hand, elevated BNP levels have an independent prognostic significance for AF progression and may help identify pts at risk from permanent AF development.

P210

Continuous rhythm-monitoring following catheter ablation of paroxysmal or persistent atrial fibrillation, long term data of patients with implanted pacemaker or ICD

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Introduction: Recurrent AF after catheter ablation (CA) may be asymptomatic and success may therefore be overestimated. An implanted pacemaker (PM) or ICD allows for continuous long-time rhythm monitoring and facilitates an objective follow-up (FU) after CA.
Methods: Since 2005 79 pts with PM or ICD with atrial holter function (holter) underwent CA for persistent (persAF) or paroxysmal AF (PAF) and were followed since then PVI alone or CA using the "stepwise approach" were performed according to the entity of AF. Holter interrogation was used to determine AF burden at the last available FU and at the time of CA.
Indications for PM or ICD were: 54% (n = 43) sick sinus syndrome, 21% (n = 13) AV block and 14% (n = 12) bradyarrhythmia. ICD was implanted in 10% (n = 11).
Results: In 36 pts (46%) CA for PAF and in 43 pts (54%) CA for persAF (43 male (54%), age 65.1 ± 12.4 years) was conducted. Holter data before CA were available for 7.1 ± 3.4 months and showed a mean AF-burden of 41% ± 32%.
There was a significant difference between AF-burden before and after ablation in all patients (41% ± 32% to 9% ± 22%, $p < 0{,}001$), in patients with PAF (26% ± 25% to 1% ± 5%, $p < 0{,}001$) and with persAF (56% ± 31% to 16% ± 28%, $p < 0{,}001$). (Table 1)
Conclusion: The holter function allows an objective continuous rhythm monitoring for AF recurrences and shows the significant difference with regard to AF-burden before and after ablation. Depending on AF entity freedom from AF after CA can be achieved in up to 70%, although a substantial amount of asymptomatic recurrences could be detected by continuous rhythm monitoring.

	all (n = 79)	PAF (n = 36)	persAF (n = 43)	p
FU after indexprocedure (years)	2,4 ± 1,9	1,9 ± 1,7	2,8 ± 2	ns
Arrhythmia recurrence (n [%])	35 [44]	11 [31]	24 [56]	0,156
Symptomatic recurrences (n [% of recurrences])	18 [51]	4 [36]	14 [58]	1
procedures/ patient	1,7 ± 1	1,5 ± 0,9	1,9 ± 1	ns

P211

Outcome of thoracoscopic epicardial left atrial posterior box lesion with bipolar radiofrequency energy in treatment of longstanding persistent atrial fibrillation

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Purpose: Catheter ablation of longstanding (>1 year) persistent atrial fibrillation (AF) is associated with poor outcome. Biatrial surgical Maze is highly successful, but requires extensive surgery. Minimally invasive surgical ablation with unipolar radiofrequency (RF) energy may lack transmurality and intraoperative testing of transmurality is challenging.
Therefore, feasibility and efficacy of a box isolation of the posterior left atrium (LA) including the pulmonary veins using bipolar RF energy performed by the cardiothoracic surgeon and with intraoperative testing of transmurality by the cardiologist was investigated with this study.
Methods: Patients underwent a bilateral thoracoscopic isolation of the box using a bipolar RF clamp. Ablation was performed using 7-8 applications on each side. Entrance block of the pulmonary veins and box was tested by recording electrograms at 0.05 mV/mm, while exit block was confirmed with pacing at 10.0 V/2 ms. Efficacy of ablation was established after 3, 6,12 and 24 months follow-up with ECG and 24-hour Holter recordings.
Results: A total of 24 consecutive patients were included (75% male, age 58 ± 7 years, LA size 45 ± 5 mm, persistent AF duration 2.0 ± 0.8 years). In all patients, intraoperative entrance and exit block was achieved. After a mean follow up of 14 ± 7 months (with a minimum of 7 months), 83% of patients were in sinus rhythm (SR). Four patients had AF-recurrences, of which two regained SR after an additional catheter ablation procedure for paroxysmal AF and one patient after reintroduction of anti-arrhythmic drugs. After the thoracoscopic procedure, one patient required surgical evacuation of pericardial fluid and one patient died within a month due to a cerebral-vascular accident.
Conclusions: Treatment of longstanding persistent AF with thoracoscopic epicardial LA posterior box isolation using bipolar RF energy and with intra-operative testing of conduction block by the cardiologist is feasible and highly effective.

P212

Mesh ablator vs. Cryoballoon vs. PVAC for pulmonary vein ablation of symptomatic paroxysmal atrial fibrillation: acute and long term results

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Background: Pulmonary Vein Isolation (PVI) is the mainstay of catheter ablation for Atrial Fibrillation (AF). New energy sources and catheter designs have been developed to achieve PVI safer, faster, and with equal efficacy as compared with the conventional radiofrequency approach. Balloon or ring -based catheter ablation systems are promising because they allow for a 'single shot' PVI.
We report our data of atrial fibrillation ablation with three different systems: HD Mesh Ablator (MESH), Arctic Front Cryoballoon (CRYO), Pulmonary Vein Ablation Catheter (PVAC) ring-shaped multielectrode.
Methods: Sixty-four patients underwent PV ablation for symptomatic paroxysmal AF using the MESH (24 pts, group A) the CRYO (20 pts, group B) or PVAC (20 pts, group C). PVI was assessed by MESH or PVAC catheter itself or with a multipolar circular catheter for CRYO and if not achieved, PVI was completed with radiofrequency (RF) retouch with a 4 mm irrigated tip ablation catheter.
Primary endpoints were acute complete PVI and freedom from AF at long-term follow-up.
Results: Patients' mean age was 56.1 years and 50 pts (78%) were male. PVI was achieved with the catheter alone in 59/89 PVs (66%) of group A (MESH), 75/80 PVs (94%) of group B (CRYO) and in 75/78 (96%) of group C (PVAC). With RF retouch PVI was achieved in 87/89 PVs (98%) of group A (MESH), 80/80 (100%) of group B (CRYO) and 78/78 (100%) of group C (PVAC). Reversibile phrenic nerve palsy was documented in 2 pts of CRYO group. No major complications and/or clinically evident stroke were observed in each group.
After at least 1 year follow-up (range 13- 60 months), pts free from AF were: 8/24 (33 %) of group A (MESH), 18/20 (90%) of group B (CRYO) and 17/20 (85%) of group C (PVAC).
Conclusions: The present study revealed a superiority of the Arctic Front Cryoballoon and PVAC with respect to HD Mesh ablator concerning acute complete PVI and long-term freeedom from AF recurrences.

P213

Pulmonary vein isolation for atrial fibrillation has no short-term effect on cognitive function: a comparison of different ablation techniques

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Purpose: Clinically silent cerebral ischemia (SCI) on diffusion MRI has been recently demonstrated after pulmonary vein isolation (PVI) by several investigators. The occurence of these lesions has been shown to correlate with the ablation technology used: phased radiofrequency technique using circular multipolar catheter (PVAC) has been associated with the highest while cryoballoon ablation (CBA) with the lowest incidence of SCI. As the clinical relevance of these brain lesions is unknown, we studied the effect of PVI on cognitive function using different ablation techniques and antiocagulation protocols.
Methods: Consecutive patients undergoing PVI were randomized to PVAC ablation and intraoperative target ACT >250 sec (10 patients, Group 1); PVAC ablation and ACT > 320 sec (25 patients, Group 2) and CBA (9 patients, Group 3). Six patients with AF but no catheter ablation were selected as age-, sex-matched controls.A battery of neuropshychologic tests were performed at baseline and 6 weeks postablation including Rey Auditory Verbal Learning, Halstead-Reitan Trail Making Tests Parts A and B, Wechsler Adult Intelligence Scale, Verbal Fluency Test, Brickenkamp D2 Test of Attention. All groups were similar for baseline characteristics. Between-group differences in cognitive performance were analyzed using analysis of covariance. Post-intervention performance was used as the outcome variable, and baseline performance and group membership as explanatory variables. In addition to each cognitive test analyzed separately, a compound test score obtained as the sum of standardized, direction-corrected test scores was also evaluated.
Results: Clinical signs of cerebral ischemia did not occur in any of the patients. A significant decline was observed in both PVAC groups during Trailmaking A Test ($p = 0.007$ in Group 1 and $p = 0.008$ in Group 2). No statistically significant difference in the compound test scores was found at an individual level in the whole study cohort ($p = 0.8$). Similarly, no group difference was found.
Conclusions: Our results suggest no clinically significant short-term effect of PVI on global cognitive function using CBA or PVAC techniques.

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Intra-tissue ablation & visualization system to monitor lesion formation to minimise extracardiac ablation

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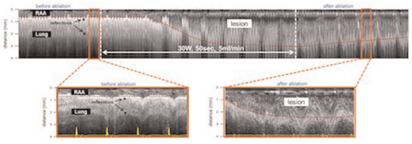
Aim: Ablation beyond the cardiac boundary can have devastating consequences. We developed an RF ablation catheter with multiple ultrasound (US) transducers to monitor in real time atrial wall thickness, extra-cardiac tissue and visualise lesion formation in real time. The aim of the present study was to differentiate between tissue types and visualise ablation of cardiac and extra-cardiac tissue.
Methods: 16 sheep were used in this study with a total of 104 attempts of lesion formation in the atria. Lesions were made using a 7Fr open irrigated RF ablation catheter with 4 US transducers in the 5.3mm ablating electrode to assess in real time the atrial wall boundary and lesion formation. Mean power delivery was 32 ± 4W, with RF delivered between 13-120 seconds. Lesion geometry and US images were blindly assessed by a pathologist or 3 operators respectively.
Results: Characteristic atrial contraction was seen at all sites where lesion delivery was attempted. RF delivery resulted in 69 (66 %) lesions detectable at pathology, 61 of which were transmural, and were correctly seen on US in 73% of cases. In 53 lesions the lung was within 0.9 ± 0.7 (0.2-2.8) mm of the cardiac boundary as assessed by US. Ablation of the adjacent lung occurred in 29 lesions and was identified by US in 82%. When the lung was not visualised on US there were no adjacent lung lesions.
Conclusion: US integrated into a RF ablation catheter can accurately differentiate between tissue types based upon reflection and contraction patterns. This allows lesions to be delivered safely, minimising extra cardiac damage.



P215

A segmental approach is superior to a circumferential approach for pulmonary vein isolation using the endoscopic laserballoon

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Purpose: Pulmonary vein isolation (PVI) can successfully be performed using the endoscopic laserballoon. To date, the feasibility of a circumferential as compared to a segmental PVI approach has not been assessed.
Methods: Patients with paroxysmal or short-standing persistent atrial fibrillation (AF) were assigned in a 1:1 fashion to circumferential (group A) or segmental PVI (group B). Circumferential PVI could only be attempted if the ipsilateral inferior PV was visible while the laserballoon was positioned within the superior PV and vice versa. Otherwise, segmental PV was performed.
Results: A total of 36 patients were enrolled (group A: 18 patients, age 61 ± 7 years, LA-diameter 43 ± 5 mm and group B: 18 patients, age 62 ± 10 years, LA-diameter 43 ± 4 mm). In group A, circumferential PVI was attempted in 2/18 (11%) right-sided PVs (RPV) and in 18/18 (100%) left-sided PVs (LPV) and ultimately successful in 2/2 (100%) RPVs and 10/18 (56%) LPVs. In the remaining patients in group A, 15/18 (83%) right superior PVs (RSPV), 16/18 (89%) right inferior PVs (RIPV), 5/18 (28%) left superior PVs (LSPV) and 5/18 (28%) left inferior PVs (LIPV) were isolated using a segmental approach. RF touch-up was necessary in 1/18 (6%) RSPVs and in 3/18 (17%) LPVs. In group B, 18/18 (100%) RSPVs, 18/18 (100%) RIPVs, 17/18 (94%) LSPVs and 17/18 (94%) LIPVs were successfully isolated. In 1/18 (6%) LSPVs and in 1/18 (6%) LIPVs, RF touch-up was performed. Procedure and fluoroscopy times were 204 ± 59min and 28 ± 10min in group A and 187 ± 24min and 26 ± 6min in group B.
Conclusions: Circumferential laserballoon-based PVI is difficult to achieve for the right-sided PVs and only moderately successful for the left-sided PVs. In addition, RF touch-up is more frequently necessary to achieve successful circumferential PVI. Hence, the preferred ablation strategy should be a segmental approach.

P216

Optimization of electrogram filtering enables activation mapping of wavelets during human atrial fibrillation. insights from multi-electrode mapping in AF

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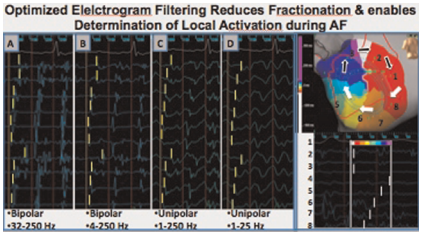
Introduction: Activation mapping of AF drivers (sources & rotors) is challenging because of the presence of EGM fractionation & multiple deflections during AF. We assessed the impact of EGM recording and filtering technique on degree of EGM fractionation and ability to map Af wavelets.
Methods: Regional AF mapping was performed in 10 pts with persist. AF in uni- & bipolar modes using two 20-pole catheters (AFocus, PentaRay). AF was recorded for 60 sec. EGM fractionation (deflection number) & the ability to map AF wavelet activation were compared between different recordings (uni- vs. bipolar) and filterings (1-25 Hz vs. 30-250Hz and 1-250Hz).
Results: Continuous fractionation was found at 38+/-8% vs. 14+/-7% of LA when bipolar CFE maps were created with 30-250Hz vs. 1-25Hz ($p < 0.01$). AF wavelet mapping was feasible at 78+/-11% of mapped regions when filters were set to 1Hz to 250Hz, especially in unipolar recording mode. Conventional EGM filtering (30-250Hz) was associated with high frequency multi-component (fractionated) EGMs that hindered activation mapping of AF. Number of EGM deflections was 2,2 fold higher with bipolar recording (at 30-250Hz) than in unipolar mode at 1-250Hz: (84 +/-16 vs. 34+/-12 deflections per sec AF, $p < 0,001$). EGM filtering at 1-250Hz revealed repetitive regional pivoting and slow conduction channels in AF.
Conclusions: Activation mapping of AF wavelets is feasible using high pass EGM filtering from 1Hz instead of 30Hz both in bi- & unipolar recording mode. Regional disparities in conduction with pivoting can be observed. Introduction of these novel EGM filtering methods enables visualization & identification of AF drivers.



P217

A three-year improvement in quality of life, hospitalizations and working incapacity after ablation for paroxysmal versus long-standing persistent atrial fibrillation

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Introduction: This prospective study compared quality of life (QoL), hospitalization for cardiovascular reasons (HCR), and working incapacity (WI) between patients with paroxysmal AF (PAF) and long-standing persistent AF (LSPAF) undergoing catheter ablation.
Methods: The study consecutively included 285 PAF and 127 LSPAF patients (aged 57 ± 10 vs. 59 ± 9 years, p = 0.04; 33 vs. 21% F, p = 0.78) who underwent their first AF ablation between I/2007 and VII/2009. Annually assessed QoL using EQ-5D questionnaire, and sum of HCR and WI days were collected at baseline and during subsequent 3 years. Respondence rate was 100%, 95%, 95%, and 90%.
Results: In PAF vs. LSPAF groups, 86 vs. 87% patients were in stable SR at the end of 53 ± 9 month follow-up after 1.4 ± 0.6 vs. 1.7 ± 0.8 procedures/patient (p = 0.00004). LSPAF patients exhibited worse baseline values of EQ-VAS/EQ-5D; however, their improvement was steeper reaching QoL comparable to PAF patients after 3 years (Table). HCR/WI were reduced significantly already in the first post-ablation year in both groups. After 3 years, HCR days per/patient/year decreased from baseline 3.8 ± 7.4 to 0.8 ± 2.9 vs. from 3.7 ± 6.0 to 0.8 ± 5.7 (both $p < 0.0001$) in PAF vs. LSPAF patients. Similarly, WI days decreased from 12.5 ± 41.4 to 1.2 ± 10.2 days (p = 0.0001) vs. from 20.5 ± 61.6 to 0.7 ± 5.7 days ($p < 0.0001$) without significant inter-group differences.
Conclusion: LSPAF patients have significantly worse QoL at baseline than PAF patients. They required more repeat ablation procedures to reach comparable clinical outcome. However, overall benefit from SR restoration in terms of QoL was higher in LSPAF patients. Ablation significantly reduced HCR/WI in both groups.

	PAF	LSPAF	p
EQ-VAS baseline	66.4 ± 14.2	61 ± 14.2	0.0005
EQ-5D baseline	71.4 ± 9.2	67.7 ± 13.8	0.002
EQ-VAS 1 year	69.0 ± 13.9	65.8 ± 14.6	0.04
EQ-5D 1 y year	74.2 ± 11.3	73.1 ± 15.0	0.40
EQ-VAS 2 years	73.1 ± 15.0	70.5 ± 14.5	0.11
EQ-5D 2 years	77.7 ± 14.8	75.9 ± 15.2	0.26
EQ-VAS 3 years	71.4 ± 16.4	71.1 ± 14.2	0.86
EQ-5D 3 years	77.2 ± 15.4	77.1 ± 14.0	0.95

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Homogenous lesion formation as mechanism for higher procedural efficiency of the novel entire-tip irrigated rf ablation technology (thermocool sf) in patients undergoing pulmonary vein isolation

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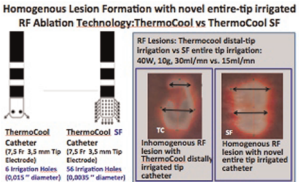
Background: Irrigated tip RF catheter ablation is the most frequently used technology for PVI. We assessed RF lesion size between the novel entire-tip irrigated SF catheter and the classical distally irrigated-tip catheter (ThermoCool, (TC)).
Methods: Lesion formation was assessed using both types of irrigated RF catheters (TC & SF) in an ex-vivo model using a porcine heart in a 37,3°C NaCl 0,9% perfused bath. RF was applied for 60sec in (ortho & parallel), at 20W, 30W and 40W & 10g, 20g, 30g&variable cooling rates. RF lesions were stained using TTC and measured by surface planimetry in 3 planes.
Results: Up to 30W, the irrigation rate was 8ml/mn vs 17ml/mn and above 30W, 15ml/mn vs 30ml/mn for SF vs. TC. At 20W and 30W both catheters produced similar lesion sizes in all 3 planes.
However, at power settings >30W with higher irrigation rates (15 ml/mn & 30 ml/mn for SF and TC), lesions were more homogenous (see figure) with lesion surface areas 12%+/-5% larger with SF vs TC. Under high irrigation rates, the TC catheter produced irregular lesions, because of asymmetrical, more distal electrode cooling. In contrast, the SF catheter with its homogenous & slow flow cooling, produces lesions without evidence of inhomogenities/gaps.
At 40W & 10g, 80% vs 25% of lesions showed inhomogenities at the ablated myocardium (TC vs SF, respectively, $p < 0,05$). Furthermore, at 40W & 20g, steam pop ocurred in 58% vs 22% of RF applications (TC vs SF, respectively, $p < 0,05$).
Conclusion: The clinically observed shorter RF duration for PVI with SF vs TC, may be due to more homogenous lesion formation with the novel SF catheter, especially at high cooling volumes. Ablationists should be aware of these differences, to avoid complications by adjusting for power & CF during ablations.



P219

Biventricular distribution of human ventricular fibrillation rotors

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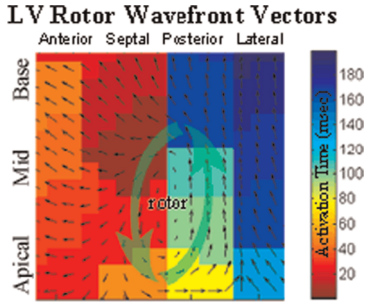
Introduction: Rotors have been demonstrated in human ventricular fibrillation (VF), but their distribution is unknown. We hypothesized that VF rotors would exist in both ventricles at electrophysiology study.
Methods: In patients presenting for ventricular arrhythmia ablation, we induced VF per approved protocol. We recorded endocardial activation during VF using 64-electrode catheters in the left (LV) and right (RV) ventricles during defibrillator charging. We used Focal Impulse and Rotor Modulation (FIRM) mapping () to identify rotors during VF, defined as rotational activation about a singularity point for ≥4 revolutions.
Results: In 22 patients (65 ± 10 years, EF 45 ± 19%), 30 episodes of VF were induced. VF was initiated in 12/12 (100%) patients with structural heart disease vs 4/10 (40%, p = 0.003) with preserved EF. VF episodes requiring defibrillation were 11.5 ± 2.9 seconds in duration; average cycle length was 208 ± 25 ms. Rotors were identified in 18 of 30 (60%) episodes. Figure shows a rotor in the posteroseptal LV (curved arrows) in a 73 year old patient with nonischemic cardiomyopathy and frequent ICD shocks. In the 18 episodes of VF with rotors, 23 rotors were observed, with a similar distribution in the LV (n = 14) and RV (n = 9, p = 0.4).
Conclusions: VF rotors are common in human VF, observable using a percutaneous FIRM mapping approach, and present in both ventricles. These findings may have implications for future therapies of VF.



P220

Association between endocardial and epicardial unipolar mapping and late enhancement imaging scar characteristics in patients with prior myocarditis-related ventricular tachycardia

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Purpose: Substrate-based ablation of ventricular tachycardia (VT) relies on electroanatomical mapping (EAM) and information from late enhancement (LE) imaging may provide supplementary information. We assessed the relation between EAM and LE imaging scar characteristics in patients with prior myocarditis-related VT.
Methods: We analyzed endocardial and epicardial uni/bipolar voltage maps and LE imaging data in 19 patients with prior myocarditis-related VT. Cardiac MR imaging was used in 15 patients and multidetector CT in 4 patients. EAM during the baseline rhythm was performed using the CARTO system (Biosense Webster Inc, Diamond Bar, CA). A value of 1.5 mV defined normal LV bipolar electrogram amplitude and a value of 8 mV defined normal LV unipolar electrogram amplitude both at the endocardium and epicardium. Dense scar was defined as an area with bipolar amplitude ≤0.5 mV and unipolar amplitude ≤5 mV. Intermediate values defined border zone. The LV location (using a 17-segment model) and pattern (subendocardial, mid-wall, subepicardial, or transmural) of LE were assessed in all patients. EAM scar location was also based on the same 17-segment model.
Results: LE scar was localized to the basal and mid inferolateral walls in the majority of patients. Scar extension was only subepicardial (SS) in 10/19 patients and reached the mid-wall layer (MS-SS) in the remaining 9 patients. Endocardial bipolar mapping revealed border-zone scar in 1 patient and unipolar mapping (<8mV) in 12/19 patients (63.2%). Segment per segment correspondence of LE scar localization with endocardial bipolar map was only 1% and with endocardial unipolar map was 23.7%. Epicardial bipolar mapping revealed border-zone scar in 14 of 19 patients (73.7%) and unipolar mapping in 18/19 patients (94.7%). Segment per segment correspondence of LE scar localization with epicardial bipolar map was 39.8% and with epicardial unipolar map was 66.2%.
Patients with a greater extension of scar (MS-SS vs. SS pattern) had more frequently identifiable epicardial bipolar dense scar (70% vs. 22.2%, p = 0.037). Endocardial unipolar compared to bipolar mapping detected a scar more frequently (44.4% vs. 0%, p = 0.023) in patients with only SS pattern. Endocardial unipolar compared to bipolar mapping detected a scar more frequently (80% vs. 10%, p = 0.002) in patients with MS-SS pattern.
Conclusion: Epicardial unipolar mapping (cutoff of 8 mV) appears superior in scar identification in patients with prior myocarditis. Epicardial bipolar and endocardial unipolar mapping may identify scars extending from the subepicardium to the mid-wall layers of the LV.

P221

Electroanatomical substrate-guided catheter ablation of ventricular tachycardia: is additional activation mapping required to improve results?

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Introduction: Advanced mapping techniques efficiently guide complex ventricular tachycardia (VT) ablation by identifying putative arrhythmogenic sites in sinus rhythm: the adjunctive value of activation mapping (AMap) has not been elucidated. We sought to define the role of AMap in patients with structural heart disease undergoing electroanatomical substrate-guided ablation of VT.
Methods: We prospectively enrolled 89 patients (age 66.2 ± 11.9, ejection fraction 37.6 ± 11.0%) with ischemic (64) or idiopathic (25) dilated cardiomyopathy undergoing endocardial or endo-epicardial electroanatomical mapping and ablation of hemodynamically tolerated and non-tolerated VT(s). The efficacy of AMap was assessed with respect to VT suppression when predefined safety criteria were met. A substrate-guided ablation strategy targeting surrogate markers of reentry was accomplished in all patients; an epicardial approach was required in 15. VT-free survival at one year was assessed by ICD interrogation.
Results: AMap successfully guided ablation in 51/82 patients (62.2%) with inducible VT(s). At one year, 5/89 patients (5.6%) died; VT recurred in 18/89 (20.2%). No significant difference in VT recurrence rate was observed between patients in whom AMap proved effective versus those who were treated only by a substrate-guided ablation strategy (10/51, 19.6% versus 8/38, 21.1%; p: ns).
Conclusions: Our findings support the efficacy of a substrate-guided ablation strategy targeting specific markers of arrhythmogenicity identified during sinus rhythm. AMap was effective in most patients but did not contribute to a higher VT-free survival, suggesting that in patients with advanced cardiac disease life-threatening arrhythmias can be effectively treated by ablation in sinus rhythm, thus limiting procedural risks.

P222

Lower catheter tip temperatures are associated with inhomogeneous lesion formation during radiofrequency catheter ablation in a canine thigh muscle model

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Purpose: Previous studies on open irrigation radiofrequency (RF) ablation catheters focused on created lesion volumes, and did not evaluate lesion quality. The aim of this study was to evaluate the effect of different irrigation levels on lesion quality and volume.
Methods: A canine thigh model was used. A skin incision was made and a cradle was created and filled with blood (37 °C, 250 ml/min). The ablation catheter was positioned parallel or perpendicular to the muscle surface using a constant force of 10 g. RF lesions were created using a gold tip electrode catheter with 12 irrigation holes and a PtIr catheter with 6 irrigation holes (Biotronik, Berlin, Germany). Both catheters were 7F and had a 3.5 mm electrode tip. RF current was delivered for 60 s at either 50 W (n = 18) or 30 W (n = 39). Temperature probes were inserted immediately below the surface and at 3.5 and 7 mm depth. Histological examination was performed to evaluate lesion size as well as the homogeneity of the RF lesions. Inhomogeneity was defined as a visual observed multi-band lesion pattern indicating different histological characteristics. Electrode temperature and lesion dimensions were measured.
Results: Data of 57 lesions, created in a mongrel dog model, were analyzed. A total number of 47 inhomogeneous and 10 homogeneous lesions were detected. Inhomogeneous lesions were deeper (7.5 ± 1.4 vs. 6.3 ± 2.1 mm, p = 0.036), however lesion volume was comparable between the two groups (652 ± 487 vs. 834 ± 396, p = 0.249). Lesions with inhomogeneous histological characteristics had lower maximum electrode temperatures during ablation (42.9 ± 6.6 vs. 48.2 ± 8.6 °C, p = 0.049). The mean temperatures at 3,5 and 7 mm below the muscle surface were lower for inhomogeneous lesions (41.2 ± 8.1 vs. 50.2 ± 21.4 °C, p = 0.035; 38.7 ± 4.0 vs. 45.2 ± 19.0 °C, p = 0.034). Inhomogeneity of the lesion was not associated with catheter type (p = 0.164), orientation (p = 0.185), amount of saline infusion (p = 0.305) and power output (p = 0.213).
Conclusions: Our data suggest that lower catheter tip and tissue temperatures are associated with the development of inhomogeneous acute RF lesion formation. The presence of inhomogeneous RF lesions can theoretically be responsible for the differences between acute and chronic ablation success rates.

P223

Local ventriculo-atrial intervals during tachycardia and entrainment: diagnostic value for supraventricular tachycardia mechanism

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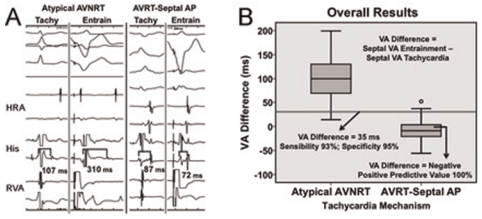
Purpose: Septal accessory pathways (AP) or AV nodal re-entrant tachycardias (AVNRT) commonly mediates supraventricular tachycardia with concentric atrial activation. When long ventriculo-atrial (VA) intervals are observed, additional maneuvers are required for diagnosis. We described the behavior of septal VA intervals during tachycardia and entrainment from right ventricular apex (RVA), which predicts the tachycardia mechanism.
Methods: Electrophysiological evaluation concluded atypical AVNRT or ortodromic tachycardia (AVRT) by septal APs based on classical maneuvers. We focus on the differential behavior of the septal VA intervals (parahisian location) during tachycardia and entrainment. We compute the local VA difference (VADif) as the subtraction defined by: VA during entrainment from RVA – VA during tachycardia. We hypothesized that, in contrast with AVNRT, an invariable sequence of activation during septal-AP mediated tachycardias will remained the subtraction closer to 0.
Results: we analyzed 42 atypical AVNRT and 40 AVRT (AP location: 16 parahisian, 5 midseptal and 19 posteroseptal). VADif was longer for AVNRT (101.5 ± 41.9 ms) compared with AVRT mediated by septal AP (-7.4 ± 21.8 ms; p < 0.05). A cut-off value of 35 ms showed 93% sensibility and 95% specificity for the tachycardia mechanism (area under COR curve 0.99; CI 95%: 0.98-1). According with physiological criteria, a negative value as a result of the subtraction remains unobserved if AVNRT support the tachycardia mechanism (Positive Predictive Value 100% for AVRT).
Conclusions: Differences in the subtraction between septal VA intervals add additional information for discrimination between atypical AVNRT and AVRT mediated by septal AP. Also, a negative value remains diagnostic of a tachycardia mechanism based on septal AP.



P224

Single center experience of fluoroless AVNRT ablation guided by electroanatomic reconstruction in children and adolescents

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Purpose: Anatomical considerations and risks related to x-ray exposure make atrio-ventricular nodal reentrant tachycardia (AVNRT) ablation in pediatric patients a concerning procedure. We aimed to evaluate the feasibility, safety and efficacy of performing fluoroless slow pathway cryoablation guided by the electroanatomic (EA) mapping in children and adolescents.
Methods: Twenty one consecutive patients (mean age 13.5 ± 2.4 years) symptomatic for AVNRT were prospectively enrolled to right atrium EA mapping and electrophysiological study prior to cryoablation. Cryoablation was guided by slow pathway potential and performed using a 4-mm tip catheter.
Results: Sustained slow-fast AVNRT was inducible in all the patients with a dual AV nodal physiology in 95%. Acute success was achieved in 100% of the patients with a median of 2 cryo-applications. Fluoroless ablation was feasible in 19 patients, while in 2 subjects 50 and 45 seconds of x-ray were needed due to difficult vascular accesses. After a mean follow-up of 25 months AVNRT recurred in 5 patients. All the recurrences were successfully treated with a second procedure. In 3 patients a fluoroless cryoablation with a 6-mm tip catheter was successfully performed, while in the remaining 2 patients a single pulse of 60 s of radiofrequency energy was applied under fluoroscopic monitoring. No complications occurred.
Conclusions: Combination of EA mapping systems and cryoablation may allow to perform fluoroless slow pathway ablation for AVNRT in children and adolescents in the majority of patients. Fluoroless slow pathway cryoablation showed a high efficacy and safety comparable to conventional fluoroscopy guided procedures.

P225

A new criterion based on virtual unipolar electrogram morphology to distinguish left from right outflow tract tachycardia origin

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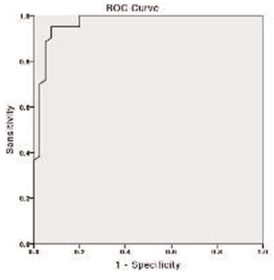
Purpose: The aim of our study was to develop a new criterion for distinguishing right ventricular outflow tract (RVOT) from left ventricular outflow tract (LVOT) origin, in patients with idiopathic outflow tract tachycardia, by analyzing virtual unipolar electrograms (vEGMs) using a non-contact mapping system.
Methods: All patients who underwent a successful ablation procedure for RVOT/LVOT premature ventricular contractions (PVC) or ventricular tachycardias (VT) were included. We analyzed the virtual unipolar EGM morphology of the PVCs or VTs, measuring the voltage peak negative (VPN) of the unipolar EGM and time to VPN from the earliest activation (EA). We then calculated the gradient of the downslope of the vEGM by evaluating voltage amplitude at 10, 15 and 20 ms after EA and ratio between voltage amplitudes at 10,15 and 20 ms after EA and VPN.
Results: We analyzed retrospectively the virtual EGM morphology of 100 patients (mean age 37.27 ± 14.5 years) who underwent a successful ablation procedure. Patients with RVOT foci had a significantly higher peak negative voltage (p < 0.001) and shorter time to peak negative voltage (p < 0.001) than patients with LVOT foci. The gradient of the downslope of the vEGM was significantly steeper in patients with RVOT origin (p < 0.001). In a multivariate logistic regression the strongest predictor of left sided origin was the the ratio between the voltage amplitude at 20ms after EA and VPN (p = 0.0002, OR <0.0001). A V20/VPN ratio ≥0.505 had a sensitivity of 95% and a specificity of 90% for right sided foci. A receiver operating characteristic curve for V20/VPN is illustrated in Figure 1.
Conclusions: The V20/VPN ratio is a new criterion that can be useful for ablation procedures to distinguish left from right outflow tract tachycardia origin



P226

Utility of a contact force catheter on atrial based right sided radiofrequency ablation

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Background: The force applied to ablations catheters is now available as a new tool in order to increase security and to better ascertain when the catheter is in close contact to tissue interface. The only other ways to indirectly know these variables were the bending of a catheter when applied perpendicular to a heart wall, or the amplitude of the signals (in absence of scar) as a surrogate, the higher the amplitude, the better the contact.
Methods: Consecutive patients (pts) undergoing atrial based ablations in a non fluoroscopic program were studied by the same operator, blinded to the force measured while acquiring the right atrium 3-D anatomy, with an 8 F commercially approved ablation catheter (SmartTouch, Biosense Webster). All points acquired were post processed validating the amplitude (mV) and force (g) measured, all points acquired in the ventricle were manually deleted. A good contact was defined as having 10g or higher force for each point.
Results: Eleven pts were studied, age range 33-73 years old, 6 men; one EP study, 4 AVNRT, 2 AVRT and 4 flutter. Mean total procedural time (105min Flutter, 100min ANVRT, and 167min AVRT), ablation time (208-449 seconds) and number of lesions applied (3-12) were similar to previous non fluoroscopic based ablations for each arrhythmia studied. Median number of points acquired for each right atrium was 363 (range 139-772), median number of points with good contact was 118 (range 19-257). There was no difference in volume when the right atrium was assessed using all points versus the ones with good contact (227.5 cm2 vs 215.1 cm2). There was absolutely no subjective difference between forces ranging from 1-77g to ascertain good or poor contact. There was no correlation between the force measured and the voltage recorded (mean r = 0.19 -Spearman's rank correlation coefficient- range: -0.05 to 0.48). For AVRNT and AVRT pts all effective lesions were applied with a force less than 10 g. In flutter ablation half of the points did not have good contact (extreme posterior and extreme anterior isthmus), but it doesn't preclude at the end to achieve bidirectional block.
Conclusion: In normal healthy right atrial myocardium, a good contact does affect neither the acquisition of 3-D geometry, nor the acute success of the ablation; however a higher voltage is not a surrogate of good contact. As a wide variation in force/contact does not correlate with subjective sensation of force applied, or electrogramme's amplitude, this new tool does add to the security of the procedure, especially when dealing with thin chambers as atria.

P227

Catheter ablation of arrhythmias with exclusive electroanatomic mapping: a case series

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Purpose: Catheter ablation provides a curative treatment for cardiac arrhythmias. Fluoroscopy is required for catheter maneuvering inside the heart. This leads to unnecessary exposing of patients and staff to ionizing radiation that has no therapeutic use at all. Today there are several tools for non-fluoroscopic mapping to be used in electrophysiological procedures. The electro-anatomical mapping (MEA) is one of this tools. The objective of this study is to describe a series of patients in which catheter ablation was performed without the use of fluoroscopy.
Methods: a prospective series of consecutive patients sent to catheter ablation for arrhythmias that were refractory to pharmacologic treatment using only MEA for catheter guidance. Measured outcomes were the total length of the procedure, success rate and complications. Also we describe the number of cross-overs to fluoroscopy.
Results: A total 11 patients were included; 7 females (63%).Mean age was 50 $\pm$ 16.5 years. There were 4 cases (35%) of atrial flutter, 3 cases (27%) of pre-excitation syndrome, 2 cases (19%) of paroxysmal supraventricular tachycardia and 2 cases (19%) of ventricular outflow tract tachycardias. The mean procedure duration was 86.6 $\pm$ 26 min. The immediate success (at discharge) occurred in 9 patients (81%). Failures were due to the requirement of fluoroscopy (2 cases). There were no complications during the procedures.
Conclusion: This study demonstrated the feasibility of catheter ablation of cardiac arrhythmias adopting a zero fluoroscopy posture.

P228

Impact on catheter design and orientation on contact force in magnetically guided catheters

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Purpose: Magnetically guided ablation has been introduced several years ago. Tip to tissue contact is critical for lesion formation. Data comparing contact forces (CF) in this type of catheters is lacking. We evaluated two established catheters and a newly designed one in two identically constructed versions in an experimental setting.
Methods: Three different types of catheters were inserted in an 8.5 Fr, 65 cm sheath. A highly sensitive measuring instrument centered in between the 2 magnets in a conventional magnetic lab was targeted in two different orientations by application of magnetic power (0.1 Tesla) and a motor-drive (V-cas, Stereotaxis). Distance between the distal part of the sheath and the measuring instrument was 55 mm. Due to the different magnet configurations of RMT and Trignum catheters in perpendicular setting the most proximal magnet of the RMT catheter was bearly out of the sheath while the most proximal magnet of the Trignum Flux eXtra Gold and the Trignum Flux Gold were fully out of the sheath. Measurements were repeated two times in every orientation with every catheter.
Results: See table 1.
Conclusion: CF markedly varies between different types of magnetic catheters. Moreover, CF is dependent on orientation of the catheter in relation to the targeted structure in some catheters. This is likely to have major impact on lesion formation in magnetically guided ablation. Magnetic strength and distribution of the magnets as well as catheter flexibility may be crucial. Catheter behavior and potential benefit of more homogenous CF has to be evaluated.

Magnetic Catheter	Catheter version	Tip Orientation	Contact Forces (g)			Average	SD (±)
			# 1	#2	#3		
NaviStar Thermocool		parallel	6.6	6.2	6.0	6.3	0.3
NaviStar Thermocool		perpendicular	16.6	15.6	16.0	16.1	0.5
Trignum Flux Gold		parallel	6.0	6.3	6.3	6.2	0.2
Trignum Flux Gold		perpendicular	15.2	14.4	14.3	14.6	0.5
Trignum Flux eXtra Gold	(A)	parallel	6.6	7.0	6.9	6.8	0.2
Trignum Flux eXtra Gold	(A)	perpendicular	7.9	8.1	7.8	7.9	0.2
Trignum Flux eXtra Gold	(B)	parallel	6.2	6.1	5.8	6.0	0.2
Trignum Flux eXtra Gold	(B)	perpendicular	7.0	6.8	5.7	6.5	0.7

P229

Relationship between pressure and depth in an experimental model of cavoriscuspid isthmus ablation with force monitoring contact systems

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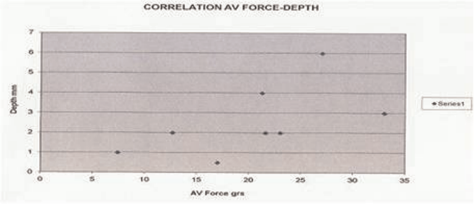
Objectives: The main objective of this study was to determine in an experimental model in pigs the depth of the lesions after performing cavotricuspid isthmus ablation with a new contact system that provides continuous pressure monitoring during radiofrequency ablation procedures.
Methodology: we performed the procedure in 8 pigs in an experimental electrophysiology laboratory. The ablation procedure was performed after right femoral vein dissection and insertion of a 12 Fr. introducer during general anesthesia and endotracheal intubation. The animals were sedated with 10 mg/kg intramuscular ketamine (ketola®) and 20 mg/kg of sodium thiopental (tiobarbital Braun®). We programmed a maximum pressure of $<$10 grs. (axial or lateral), 10-20 grs., 20-30 grs. and $>$ 30 grs. in 2 pigs each. The power set was 40 Watts with a maximum target temperature of 45 $^{\circ}$ C. We performed a RF line dragging from the tricuspid valve to the inferior vena cava in the 8 pigs. Euthanasia of the animals was performed a week after the procedure. The heart was sectioned and fixed in 10% formalin and a pathological exam of the lesions was performed. External surface was examined searching for transmural lesions and injury of extracardiac adjacent organs. In the endocardial macroscopic analysis the extent and depth of lesions, the presence of thrombus, transmurality and endothelial rupture was assesed.
Results: the mean force pressure applied was 20.3 $\pm$ 7.5 grs. and the mean depth of the lesions was 2.5 $\pm$ 1.6 mm. There is positive correlation (r = 0.59) between the average force pressure and depth of the lesions (figure).
Conclusions: Catheter-tissue contact is critical for effective lesion creation. This information is important for improving ablation efficacy.



P230

Underlying scar tissue significantly influences impedancebBased catheter tip-to-tissue contact assessment

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Introduction: Ablation efficacy depends on catheter tip-to-tissue contact. The Ensite Contact technology (St. Jude Medical) has been developed to predict catheter-tissue contact by measuring the complex impedance (ECI) at the tip/tissue interface. It correlates well with pressure, although it may be also influenced by the type of underlying tissue. The purpose of this study is to demonstrate if the ECI value depends on the underlying tissue, i.e. healthy or scar tissue.
Methods: Ten patients that underwent VT catheter ablation, late after myocardial infarction, were studied. The EnSite NavX system was used. During sinus rhythm, a point-by-point LV mapping was performed; each point had information on local bipolar voltage (EGV) and local ECI value. Each endocardial point (EP) was registered when high contact was supposed to be achieved by the operator. EP were divided into groups according to their EGV: $<$0.5, 0.5-1, 1-1.5, 1.5-2, 2-2.5, 2.5-3, 3.5-4, 4-5, 5-6, 6-8 and $>$8 mV. A cardiac MRI was performed in 4 patients before ablation to delineate myocardial scar.
Results: A stepped increase of median ECI was observed when moving from low to high EGV groups: 92 (IQR 22), 100 (IQR 23), 110 (IQR 36), 113 (IQR51), 115 (IQR 48), 130 (IQR 43), 129 (IQR55), 125 (IQR 44), 147 (IQR 76), 157 (IQR 69), 172 (IQR 74), 165 (IQR 63), $p < 0.001$. ECI dispersion (IQR) also exhibited a stepped increase. An inter-person variability was found. In a multivariate analysis, left ventricle diameter and age also had an influence on ECI. There was a good correlation between myocardial scar defined by MRI, voltage (cut-off $<$ 1,5mV) and ECI value (cut-off for each patient consisting in the upper limit of the inter-quartilic range of EP $<$ 1,5mV).
Conclusion: ECI depends on the type of underlying tissue and presents lower values in scar tissue even when tip-to-tissue high contact is achieved. There is an inter-person variability probably related to fibrosi.

P233

Incremental His-to-coronary sinus ostium distance maneuver for complete cavo-tricuspid isthmus conduction block Assessment

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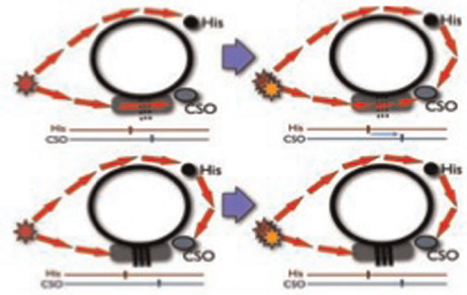
Background: Achievement of complete cavo-tricuspid isthmus (CTI) conduction block reduces typical atrial flutter recurrences after ablation. The lack of increase in the His-to-Coronary sinus ostium (CSO) interval during incremental pacing (IP) from the low lateral right atrium (LLRA) may distinguish slow conduction from complete CTI conduction block.
Methods: Sixty-six consecutive patients (age 65 $\pm$ 13 years, 18% female) were prospectively included. A $<$ 10 ms increase in the His-to-CSO distance during LLRA incremental pacing at cycle length of 600 ms through 300 ms was confronted to the previously reported IP maneuver for the confirmation of complete CTI block.
Results: On the basis of the IP maneuver complete CTI block (phase 2) was achieved in 59 patients, in 13 of whom an intermediate phase of functional CTI block (phase 1) was observed. In the remaining 7, the IP maneuver did not allow for assessment of complete CTI block due to the presence of inconclusive potentials in the CTI ablation line. As confronted to the IP maneuver, the incremental His-to-CSO maneuver was consistent with functional CTI block during phase 1 in all cases and conclusive of complete CTI block in 98% of cases during phase 2.
Conclusion: The incremental His-to-CSO maneuver is analogous to the IP maneuver in order to distinguish complete CTI block from persistent CTI conduction. This maneuver may permit for confirmation of CTI block in those patients in whom assessment of local electrogram-based criteria is not feasible due to the observation of inconclusive potentials in the CTI ablation line.



P234

Cryotherapy ablation for septal accessory pathways in children

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Background: Radiofrequency (RF) ablation has become established therapy for tachy-arrhythmias in the pediatric population. Cryotherapy is a comparable alternative to RF current for catheter ablation in both adult and pediatric population. Septal accessory pathways (APs) especially para-Hisian and antero-septal APs can be challenging targets for RF ablation due to the proximity of the normal atrioventricular (AV) conduction tissues, especially for pediatric patients. However, cryotherapy is characterized with lower acute successful rate and high rate of recurrence. This study sought to investigate the safety and efficacy of cryotherapy ablation (Cry-Ab) in the treatment of pediatric patients with septal accessory pathways.
Methods: A total of 54 patients aged 5.3-20.4 years with SVT or overt AP underwent 72 Cry-Ab procedures. They had para Hisian, right antero-septal or right mid-septal accessory pathways (37, 13 and 4, respectively). Cryo-mapping was performed at -35°C for a maximum of 60 seconds and Cry-Ab for 4 minutes at -80°C. An acute success was defined as noninducibility of SVT and conduction block over the AP.
Results: The mean age was 14.9 $\pm$ 3.8. The acute successful rate for the first ablation was 50/54 (93%). Thirteen out of the 50 (26%) had recurrence of arrhythmia, all of them had second successful ablation, but 4 of them had recurrence and success again on the third procedure. The total long term (mean follow-up of 49 $\pm$ 21 months) successful rate was 93% (50/54). The average fluoroscopy time was 28.5 $\pm$ 21.3. The total Cry-Ab time was significantly higher in the second compared to the first procedure (808 $\pm$ 380 second vs 607 $\pm$ 417, respectively, $P < 0.01$). One patient had mechanical ablation of the AP and one patient had transient complete AVB.
Conclusions: Cry-Ab is a safe and effective treatment for the ablation of APs with close proximity to the AVN in children. However, characterized with high rate of recurrence and repeated procedures to achieved high successful rate.

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Electro physiological study and ablation in children with asymptomatic Wolff-Parkinson-White syndrome

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Purpose: Asymptomatic WPW syndrome is defined as an isolated ventricular pre-excitation without any arrhythmia symptoms (palpitations, pre-syncope or syncope) or documented atrio-ventricular reentry tachycardia (AVRT) or atrial fibrillation (AF). Induction of AVRT, a shortest pre-excited RR interval (SPRRI) during AF and/or an accessory pathway effective refractory period (APERP) of less than 240 ms, the presence of multiple pathways, septal and right-sided pathway locations and younger age may identify a high risk group. Recently, an Expert Consensus Statement on the Management of the Asymptomatic Young Patient with WPW was published. Since 2002, we routinely offer an electro-physiological study (EPS) for asymptomatic children with WPW syndrome; it happens that this policy is in complying with recently published recommendations. In this work we would like to describe our experience in this group of patients.
Methods: Invasive EPS were performed in 142 (111 boys and 31 girls) asymptomatic children aged 5 to 19 years old (12.8 $\pm$ 3.5) with WPW. Children with high risk for SCD (SPRRI during AF and/or APERP $<$ 240 ms) or inducible AVRT or both underwent ablation of the AP.
Results: Seventy eight out of 142 (55%) children had a negative EPS, the rest of children 64 (45%) reached the high risk criteria or inducible AVRT or both. Among them 60/64 (93.5%) had successful ablation of the AP. The fluoroscopy time for the ablated children was 5-82 minutes (30.9 $\pm$ 21.3) compared to 1-14 min (3.5 $\pm$ 2.7) for the non-ablated children. The ablated AP were located to the left side in 20/64 (31%), para-Hisian, anteroseptal or midseptal in 13 (20.5%), right posterior in 23 (36%) and right lateral in 8 (12.5%) children. Eight children had cryoablation of the AP located in para-Hisian or antero septal region (5 and 3, respectively), the rest had RFA. One patient had transient atrio-ventricular block during cryomapping.
Conclusions: About half of "asymptomatic WPW" children had high risk criteria for SCD or were inducible for AVRT or both. Electrophysiological study and ablation of this population is safe and highly successful and compatible with the recently published expert consensus statement.

Clinical impact of late revealing ECG abnormalites in patients with idiopathic ventricular fibrillation and unknown cause ventricular tachycardia undergoing impantable cardioverter defibrillator

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Purpose: The implantable cardioverter defibrillator (ICD) is used to treat life-threatening ventricular arrhythmias and to prevent sudden cardiac death (SCD). Despite of meticulous evaluation to reveal the cause of SCD, some patients have been implanted ICD without definitive cause. However, they might have certain electrocardiogram (ECG) abnormalities during follow up. We aimed to evaluate late revealing ECG abnormalities in patients with idiopathic ventricular fibrillation (VF) or unknown cause ventricular tachycardia (VT).
Methods: We analyzed 145 patients (55.8 ± 16.6 years old, 95 males) who underwent ICD implantation from January 1999 to June 2012. 43 patients (29.7%) were designated as idiopathic VF or unknown cause VT without organic nor ECG abnormalities. ECG abnormalities including early repolarization (ER) were analyzed during 3.7 ± 2.4 years median follow-up duration. Patients were divided into Group I (n = 30, patients with ECG abnormalities) and Group II (n = 13, patients without ECG abnormalities).
Results: 30 patients (69.8%) showed ECG abnormalities during long-term follow-up after ICD implantation. 3 patients (7.0%) revealed Brugada type 2 ECG abnormalities, and 29 patients (67.4%) revealed ER. There were no differences in the clinical characteristics except that serum N-terminal pro brain natriuretic peptide level was higher in Group I (404.5 pg/ml vs. 75.1 pg/ml, p = 0.011). Electrophysiology study (EPS) before ICD implantation was performed in 31 (72.1%) patients. There were no significant differences in the rate of EPS and induced VF/VT between the 2 groups. Appropriate shock was dominantly delivered in patients with ER with horizontal/descending STE (40.4% vs. 17.4%, p = 0.038) and in patients with ER in inferior leads (43.5% vs. 10.0%, p = 0.015). ER in inferior leads with horizontal/descending ST segment was a significant predictor for the appropriate shock (adjusted hazard ratio [HR] 4.89, 95% confidence interval [CI] 1.17-17.41, p = 0.024) as well as inducible VF/VT in EPS (adjusted HR 7.5, 95% CI 1.02-14.2, p = 0.035).
Conclusions: Considerable patients had ECG abnormalities after ICD implantation, although initial meticulous evaluation did not reveal any structural or ECG abnormalities. ER with Horizontal/descending ST segment in inferior leads might predict further appropriate ICD shock.

Flecainide therapy suppresses exercise-induced ventricular arrhythmias in patients with CASQ2 associated catecholaminergic polymorphic ventricular tachycardia

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Background: Calsequestrin (CASQ2) associated Catecholaminergic polymorphic ventricular tachycardia (CPVT2) can cause sudden death in young individuals in response to stress. Beta blockers are the mainstay medical treatment for CPVT2 patients. However, they do not prevent syncope and sudden death in all patients. Flecainide was reported to reduce exercise-induced ventricular arrhythmias (EIVA) in patients with RyR2 associated CPVT (CPVT1). The role of flecainide in CPVT2 is not known.
Objective: To summarize our experience in combining flecainide and beta blockers in high risk CPVT2 patients.
Methods: All CPVT2 patients who have high risk features (syncope, EIVA, or appropriate ICD shocks) despite beta blockers with or without calcium channel blockers were treated with combination of flecainide and beta blockers. Exercise test was done before and after starting treatment with flecainide.
Results: Seven patients were treated with flecainide, 4 patients because of appropriate ICD shocks, and 3 because of EIVA. All patients already had ICD implantation. All patients have ventricular arrhythmia (ventricular premature beats and or ventricular tachycardia) during exercise test while on high dose beta blockers with or without calcium channel blockers before treatment with flecainide. In all patients combination of flecainide and beta blockers suppressed EIVA. At 24 months follow-up, 5 patients kept symptoms free. Two patients had one VT storm episode with recurrent ICD shocks each, despite negative stress test and symptoms free.
Conclusion: Flecainide can completely prevent ventricular arrhythmia during exercise test and partially prevent recurrent ICD shocks in high risk CASQ2 associated CPVT patients.

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Assessment of heart rate turbulence in ischemic cardiomyopathy patients with implantable cardioverter defibrillator (ICD) shock therapy

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Introduction: Recent studies have revealed that patients with severe left ventricular (LV) dysfunction (ejection fraction <35%), are associated with increased risk of mortality and implantable cardioverter defibrillator (ICD) shock therapy. Abnormal heart rate turbulence (HRT) is strong independent predictor of sudden cardiac death in patients with ischemic cardiomyopathy (IC). We assessed HRT parameters named Turbulence onset (TO) and Turbulence slope (TS) in IC patients with appropriate ICD shocks.
Methods: We prospectively enrolled 30 (25 men and 5 women; mean age 62 ± 9 years) IC patients (mean LVEF 23 ± 4%) with appropriate ICD shock therapy (≥4.4 ± 1.8 shock/day). Exclusion criteria were as follows: non-sinus rhythm (atrial fibrillation, paced rhythm), reversible causes of ventricular arrhythmic events. We evaluated HRT parameters by using 24-hour ambulatory Holter monitoring.
In this study, patients were defined as HRT positive when both TO and TS were abnormal (TO ≥ 0% and TS ≤ 2.5 ms/RR interval), and as HRT negative when TO and/or TS were normal (TO < 0% and/or TS > 2.5 ms/RR interval). We compared HRT parameters and other risk factors for cardiac mortality including age (>65 years), gender, presence of diabetes mellitus (DM), hypertension(HT), renal insufficiency (RI), hyperlipidemia(HL), presence of nonsustained ventricular tachycardia (NSVT), number of ventricular premature contraction(VPC) and frequent ICD shock therapy(≥4 shock/day).
Results: 6 of 30 patients were not utilized because very frequent VPCs unable to be computed. Of 24, 12 (50%) were HRT positive. HRT was not related to gender and other risk factors including HT, DM and HL (P > 0.05). Abnormal HRT parameters significantly correlated with age (P = 0.01), RI (P = 0.036), documented NSVT (P = 0.005), frequent and more complex VPC's (P = 0.037) and frequent ICD shock therapy. (P = 0.01).
Conclusions: Our study reveals that abnormal HRT can predict frequent ICD shocks in IC patients with ICD. However, further prospective investigations with larger populations are needed to get more accurate results.
Heart rate turbulence, implantable cardiac defibrillator shock therapy, ischemic cardiomyopathy.

P239

Syncope in primary prevention

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Background: Syncope may be the final common symptom for a number of clinical conditions spanning from benign conditions to life threatening diseases. Accordingly, its prognosis varies widely and 1-year mortality may range from 0% in the case of vasovagal events up to 30% in the presence of heart disease.
There is limited information regarding outcomes of patients who receive device therapy for primary prevention in patients with history of syncope (of unknown cause).
Objective: The aim of this study is to assess the outcomes and prognosis of patients who underwent ICD implantation with indication of primary prevention and compare patients that presented with or without prior syncope
Methods: We reviewed charts of 75 patients that underwent ICD implantation with the indication of primary prevention with history of syncope and compared to a control group of 80 patients without prior syncope. We assessed the number of Ventricular Tachycardia (VT), Ventricular Fibrillation, Shock, antitachycardia pacing (ATP) and death in each group during the follow up.
Results: Mean follow up was 30 months (no difference between groups). There was no significant gender difference. Although patients with prior syncope were slightly younger (65.0 $\pm$ 13.4 vs. 68.9 $\pm$ 11.7 p = 0.058), had a higher EF (35.5 $\pm$ 12.6 vs. 31.4 $\pm$ 8.76 p = 0.02), they had more episodes of VT (21.3% vs. 3.8%, p = 0.001), VF (8% vs. 0%, p = 0.01) and also received more electrical shocks (18.7% vs. 3.8%, p = 0.004) and ATP (17.3% vs. 6.2%, p = 0.031). There were no differences in inappropriate shocks (6.7% vs. 5%, p = 0.74), in cardiovascular mortality (cumulative 5 year estimate 29.9% vs. 32.2% p = 0.97) and any death (cumulative 5 year estimate 38.1% vs. 48.9% p = 0.18) during the follow up.
Conclusions: According to our data, patients that present with syncope before the ICD implantation seem to have more episodes of VT/VF and shock or ATP. However no differences in mortality were observed.

P240

Mortality in ICD recipients and the relationship with renal function

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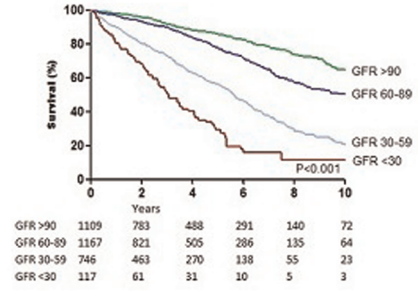
Introduction: Patients with chronic kidney disease represent a special group within ICD recipients. Sudden Cardiac Death (SCD) is an important cause of death in these patients, but they also suffer from a high burden of comorbidity and have been excluded from all pivotal ICD trials. We investigated the relationship between mortality, cause of death and renal function in a large single center cohort of ICD recipients.
Methods: All ICD and CRT-D recipients in our center since 1996 were analyzed. Patients were categorized into 4 groups based on estimated glomerular filtration rate (eGFR). An eGFR > 90 mL/min/1.73 m2 was defined as normal. We categorized cause of death as cardiac, sudden, noncardiac or unknown death. Kaplan Meier analysis was used to compare mortality.
Results: We included 3276 patients. During follow-up 871 (27%) patients died (median time to death 3.1yrs i.q.r. 1.2-5.6). Survival was worse in each group with lower GFR ($p < 0.001$, fig). Patients with GFR < 90 received appropriate therapy sooner after ICD implant when compared to patients with normal renal function (2.1 $\pm$ 0.1 vs 2.5 $\pm$ 0,1yrs p = 0.02). Patients with a GFR > 90 died most frequently from a non-cardiac cause (39%) whereas patients with a lower GFR died more often from a cardiac cause (44%). Heart failure was the most common cause of death in all patients (34%) SCD occurred in 1% of patients.
Conclusion: Patients with kidney dysfunction receive appropriate ICD therapy sooner after device implantation then patients with normal kidney function. Furthermore, survival in these patients is significantly lower, despite their device. A trial analyzing the benefit of ICD therapy in in patients with kidney dysfunction is badly needed.



P241

Predictive value of deceleration and acceleration capacity for risk stratification of sudden cardiac death in patients after myocardial infarction

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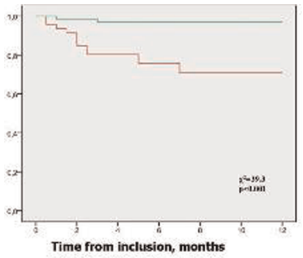
Purpose: To evaluate predictive value of deceleration and acceleration capacity (DC/AC) for sudden cardiac death (SCD) risk stratification after myocardial infarction (MI).
Methods: Study group: 111 patients after MI occurred more then 60 days before inclusion (77 men; age 64,1 $\pm$ 10,5 years). Control group: 60 comparable subjects without any cardiovascular diseases. All subjects had 24-hour ambulatory ECG monitoring with DC/AC evaluation. Follow-up was 12 months; primary endpoint was SCD, secondary endpoint included all deaths from cardiovascular (CV) diseases.
Summary: DC values were significantly lower after MI then in healthy subjects (4.2 [2.2;6.0] vs. 6,0 [4.7;7.1], respectively, <0,001). β-blockers significantly improved DC values (4.0 [1.3;5.7] vs. 4.8 [2.6;6.1] with β-blockers, <0.001), as well as amiodarone (1.7 [0.4;3.3] vs. 3,0 [2,2;4,7] with amiodarone, <0.001). There were 15 cases of SCD and 8 cases of non-sudden CV deaths. AC values showed no predictive value. DC values were significantly lower in all subgroups of lethals compare with survivals. ROC-analysis showed high diagnostic value of DC for all-cause and CV mortality (AUC 0.7 and 0.67, respectively), and for SCD (AUC 0.7). DC was characterized by high sensitivity and specificity, as well as very high NPV (98.1% for all-cause mortality and 92.9% for SCD). DC values below threshold (4.15 for all-cause mortality and 2.0 for SCD) resulted in a significant increase in risk of all-cause mortality (OR 4.96, 95% CI 1.69 to 14.57, p = 0.002) and SCD (OR 6,97, 95% CI 2.19 to 22.2, p = 0.001).
Conclusion: DC is a significant and reliable independent risk predictor for all-cause and CV mortality, and SCD in patients after MI. It is characterized by high sensitivity, specificity and negative predictive value of result.



P242

Implantable cardioverter defibrillator therapies and mortality in elderly patients. Long term follow up

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Background: Implantable cardioverter defibrillator (ICD) therapy has increased in elderly people from the results of randomized studies performed in adults, but the elderly pts have been poorly represented in these studies. Therefore, the magnitude of the survival benefit is still not well-defined. The age, probably, should not be a limitation for ICD indication.
Purpose: To compare ICD therapies and mortality between elderly patients (pts) and adults pts during a long term follow up.
Methods: A prospective analysis was performed in 257 pts with ICD and ischemic or idiopathic dilated cardiomyopathy, including 76 elderly pts (≥70 years) and 181 adults pts (21-69 years). Pts with CRT-D were excluded. Appropriate ICD therapy (AT), inappropriate ICD therapy (IT), all-cause mortality, cardiovascular (CV) mortality, survival at 5 years and a combined endpoint of survival free of heart transplant (HT) or death at 5 years were assessed. Median follow-up time was 29.3 months (range 1-99). Variables were analyzed with t-Mann-Whitney or chi^2 test and survival curves with Kaplan-Meier method and log-rank test. ICD therapies (ATP/shocks) were programmed with the same protocol in pts implanted for primary prevention.
Results: Mean age was 74.5 $\pm$ 4.4 years in elderly pts and 58.1 $\pm$ 8.1 in adults pts ($p < 0.001$). ICD as primary prevention of sudden cardiac death was implanted in 53.9% vs 64.6% (ns) respectively. The elderly pts had significantly higher prevalence of ischemic etiology, hypertension, renal impairment, atrial fibrillation, stroke and also higher mean percentage of right ventricular pacing (all p values <0.05).
The AT rate was 23.6% vs 35.3% (p:0.06) and the IT was 17.1% vs 21.5% (p:0.2) among elderly and adults pts respectively.
Elderly pts had higher all-cause mortality (32.9% vs 19.3% p:0.019) but CV mortality was not significantly different (15.7% vs 11.6%, p:ns). The survival at 5 years was 48.3 % vs 71.4% (p:0.024) but the survival free of HT/death at 5 years was 48.3% vs 62.1% (p: 0.54) between elderly and adults pts, respectively.
Conclusions: The rate of ICD therapies and CV mortality was similar in both groups. Elderly pts had a significantly higher all-cause mortality than adults pts, probably due to their comorbidities, but the combined endpoint of survival free of HT/death was similar between the 2 groups. In our study population, ICD therapy was effective for the treatment of potentially life-threatening arrhythmias in both groups.

P243

Additional criteria of long QT diagnostics and primary prevention of sudden cardiac death in athletes

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Background: Over the past few years there has appeared evidence that stress tests are valuable to diagnose different variants of long QT syndrome (LQTS) -inherited arrhythmia, highly associated with sudden cardiac death, and in come causes help to make an accurate diagnosis without genetic testing. On the other hand, many young athletes have got acquired QT prolongation.
Purpose: To develop simple and efficient methods of noninvasive diagnostics for LQTS in athletes.
Methods: We have examined 100 healthy children and 100 athletes (11-15 years old) using a bicycle test by Bruce protocol: incessant stage test with synchronic ECG recording at rest, during exercise and at minutes 3-4 of recovery period. Estimation of RR and QT intervals was performed manually. Corrected QT interval was assessed by Bazett's and Fridericia's formulas.
Results: Young athletes had lower heart rate (HR) at rest with gradual increase at physical load, while untrained children had a "jerky" heart rate growth, but at maximal loading HR in both groups did not differ. Athletes had higher values of QT interval duration at rest and at initial load stages, probably due to myocardial hypertrophy and vago-dependent sinus bradycardia. At peak load significant QT reduction (QT "hyperadaptation") occurred in athletes, while in untrained group minimal values were noted during recovery. QTc interval duration were somewhat increasing at the first load stage, beginning to decrease at the second exercise step, going down beyond the original level at maximal load and resuming the initial level by minute 4 of the recovery (like in untrained). In both healthy untrained adolescents and young athletes maximal QTc by Bazett was recorded at Stage 1, not exceeding 450-460 ms in untrained boys and girls and 460-470 ms in sportsmen. Inadequate QT shortening (QTc at maximal load > 400ms), absence of QTc restoration to the initial values by min 4 of recovery (QTc at early recovery >450ms), and significant QTc variation (difference between maximal and minimal QTc during exercise and recovery time >90 ms) revealed signs of myocardial electric instability and required further examination for LQTS diagnostics. If 3 criteria are used sensitivity amounts up to 92% and specificity up to 68%.
Conclusions: Inadequate QT shortening during exercise test in combination with the other Schwartz criteria, was evidenced the inherited or acquired LQTS. QTc prolongation at the peak of load and early recovery were noted to be additional criteria of LQTS diagnostics and primary sudden cardiac death prevention in athletes.

P244

I123-MIBG prognostic value in patients with idiopathic cardiomyopathy candidate to ICD : a pilot study

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Patients with idiopathic cardiomyopathy and EF < of 35% are a class 1 indication for ICD , currently doesn't exist another screening test to select more effectively the patients : so many of them will never utilize the device but are exposed to the risk of implant /replacement.
The MIBG scintigraphy provides information of cardiac innervations and demonstrated to be useful in prognostic stratification , it hasn't been possible identify a HM or washout rate cut-off with an high sensibility to select patients for ICD . More trials have enrolled patients with heterogeneous features (pts with ischemic and idiopathic etiology together).
Methods: Our pilot study has selected a group of 20 patients with idiopathic cardiomyopathy (EF < 35%). Coronary disease was excluded. All have indication for ICD alone (no indication to resynchronization). We have studied cardiac innervation after MIBG scintigraphy through the Heart/Mediastinum rate, the wash-out rate , evaluating a possible correlation with the left ventricular diameter.
The aim of our study is to verify if these MIBG data could be connected with arrhythmic events.
Results: Clinical and instrumental data of study group are shown in TAB
During ICD control (12 months F-U), we have observed in 3 pts : 3 VF treated with shock and 1 sustained VT . The H/M late ratio shows lower value in pts with events.
Ventricular sizes seem to have a good correlation with the H/M rate and with arrhythmias: more the left ventricle is dilated minor is the H/M late ratio.
Conclusions: Our experience seem to endorse the prognostic validity of this method comparable with ADMIRE study data: H/M late ratio >1.8 identify a group of patients with a low risk of arrhythmic events. In these patients it could be possible procrastinate ICD implant, while an H/M late <1.4 should identify a group with high arrhythmic risk.
It should be required a large cohort of patients to identify a right H/M cut-off , to reduce the grey zone with a H/M ratio between 1.4 and 1.8.

	Age	EF	LVDD	H/M late ratio
total group	65,2	29,1	65,6	1,67
arrhythmic pts		25,3	69,1	1,31 (1,2-1,4)
No arrhythmic pts		30,3	64,5	1,76 (1,43-2,1)

P245

Efficacy of primary preventive icd therapy in an unselected population of patients with reduced left ventricular ejection fraction

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Introduction: Sudden cardiac death (SCD) primary prevention guidelines advocate ICD-therapy in patients with reduced left ventricular ejection fraction (LVEF), but real-life data suggest that the benefit from ICD therapy may be lower than expected from controlled studies. The aim of our study was to evaluate primary preventive ICD performance in an unselected population of patients with congestive heart failure in regard to their risk profile.
Methods: Using ICD registry data, 104 patients with reduced LVEF, who received ICD for primary prevention of SCD during 2006-2010 in a tertiary care hospital, were identified (age 63 ± 13 years, 86% men, ischemic ethiology in 65%). The patients' records were scrutinized for the presence of clinical risk factors (age >70 years, QRS duration > 120 ms, NYHA class III-IV, presence of atrial fibrillation (AF) or creatinine > 106 μmol/l), survival status and ICD discharge. Mean follow-up was 38 ± 11 months.
Results: In 12% no risk factors (low-risk) were identified, 58% had 1-2 risk factors (medium-risk) and 30% had 3-5 risk factors (high-risk). Mean LVEF in the total population was 24 ± 6% and did not differ between groups. Yearly mortality was 6.1%, increased proportionally with risk factor group (p = 0.03), and a total of 17 patients (19%) died: 8 fromheart failure progression, 9 from other causes, none from primary arrhythmia.
Conclusions: These data support previous work that patients with medium risk score have the most benefit for primary prophylactic ICD therapy while low-risk patients do not show measurable benefit. Despite the similar rates of appropriate ICD therapies, all-cause mortality is twice as high in the high-risk than in the medium-risk group.

Events vs. risk group categories by the end of follow-up			
	Inappropriate shocks (p=n.s.)	Appropriate shocks (p=n.s.)	Death (p=0.03)
Low risk	1 (8%)	0 (0%)	1 (8%)
Medium risk	4 (7%)	5 (8%)	9 (15%)
High risk	2 (7%)	3 (10%)	10 (32%)

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Remote monitoring for implantable defibrillators: the nation-wide Italia-RPM survey

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Purpose: Remote patient management(RPM) systems permit home interrogation of implantable defibrillators (ICDs),and provide an alternative option to frequent in person visits. The Italia-RPM survey was conducted to assess the current Italian clinical practice in the use of RPM for the follow-up of ICD patients.
Methods: An ad-hoc questionnaire focusing on RPM adoption and resource use during in-clinic and remote follow-up sessions was completed in 201 Italian implanting centers.
Results: In the centers participating to the present survey, the mean visit time for routine in-clinic device check is 15 ± 7min,16 ± 8min,20 ± 9min for single-chamber, dual-chamber and biventricular ICD, respectively. Device reprogramming is required in 10% [25°-75°percentile:7-20] of visits. Follow-up visits are performed by a cardiologist in 99% of centers and by more than a single healthcare personnel in 89%.The frequency of routine ICD in-clinic visits is 2/year in 78% of the responding centers, 3/year in 17% and 4/year in 5% of centers. Sixty-seven per cent of centers are currently using RPM, scheduling remote ICD interrogations every 3 [25°-75°percentile:1-3] months. After adoption of RPM, the frequency of in-clinic visits was decreased in 71% of centers previously performing 4visits/year,63% of centers with 3visits/year and 39% of centers with 2 visits/year. Overall, the mean time between visits increased from 5 to 8 months.
Conclusions: In the current practice of a large number of Italian implanting centers, the follow-up of ICDs requires important resources in terms of time dedicated by healthcare personnel, in particular by cardiologists. In centers routinely performing frequent in-clinic visits, the adoption of RPM allows to decrease the number of hospital accesses, while in all centers it permits to reduce the interval between ICD interrogations.

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Location and degree of conductor externalization in recalled St. Jude Medical Riata defibrillator leads. Results of a nation-wide fluoroscopic screening

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Purpose: The recalled St. Jude Medical Riata defibrillator leads pose a challenge to lead management as the unique insulation defects with inside-out conductor externalization most often are electrically silent due to an intact inner insulation. The objective of the present study was to determine the occurrence, location and degree of conductor externalization in recalled St. Jude Medical Riata defibrillator leads.
Methods: A nation-wide cohort of 298 patients with active recalled Riata leads were screened with device interrogation and fluoroscopy performed in three projections at five ICD implanting hospitals in Denmark. The location of externalization was divided into three zones from lead tip to can. The degree was graded into four levels: 1. localized abnormal conductor spacing without overt externalization; 2. externalization $<$1cm length; 3. externalization $>$1cm length in one zone; and 4. externalization $>$1cm length crossing adjacent zones. Time-to-event analysis assumed interval censoring due to the common electrical silent nature of externalization.
Results: The prevalence of conductor externalization was 11% (32/298) at a mean lead dwell time of 5.1 years. The prevalence of electrical abnormalities was 6% both in patients with and without externalization. Two additional patients had abnormal conductor spacing without overt externalization. No difference was seen in the estimated hazard of externalization for 7 French vs. 8 French leads (P = .73) and single vs. dual coil leads (P = .95). The location of externalization was more common in the most distal part of the lead below the tricuspid valve annulus in dual coil leads (69%) vs. single coil leads (16%), P = .004. A higher degree of externalization was associated to longer lead dwell time with Spearman's rho = .37, P = .03.
Conclusions: The prevalence of externalization in a nationwide screening of recalled Riata leads is at the same level as reported in previous studies. The location of externalization is different between single and dual coil leads. The degree of externalization is associated to lead dwell time.

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Is post-mortem evaluation of cardiac rhythm management devices useful?

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Introduction: The number of pacemakers and implantable cardioverter defibrillators (ICD's) continues to rise worldwide. Recently there are increasing concerns about long term reliability in the setting of recalls such as Sprint Fidelis and Riata. The Heart Rhythm Society recommend explant of devices during post mortem to facilitate returned product analysis and improve monitoring of device performance. Overall little data exists on the rate, feasibility and information garnered from device interrogation post mortem.
The aim of the study was to investigate whether device interrogation provided additional information for the pathologist and whether device function was normal.
Methods: Devices were explanted from 32 consecutive post mortems, performed according to hospital protocol, between 2008 and 2011 and were sent for interrogation to the Cardiology department. Interrogation and interpretation of the device data was performed blinded to the post-mortem findings. Battery voltage, charge time, lead impedances, thresholds and intrinsic amplitude measurements were recorded. Data related to potential arrhythmias was also recorded, as was pacemaker dependency, defined as pacing $>$80%. After data collation the investigators jointly decided as to the value of the interrogation on a case by case basis.
Results: 24 pacemakers and 8 ICD's were studied. The mean age of patients at time of death was 75(range 31.8-95)yrs and the device had been implanted for a mean of 3.2(range 0-9.6)yrs. No pacemakers were subject to an advisory but 3 ICDs and 1 ICD lead were. Reassuringly all devices demonstrated normal function. Mean battery voltage was 2.75V amongst the pacemakers and 2.92V amongst the ICD's and lead impedances and intrinsic amplitude measurements were within normal ranges for all devices.
Pacemaker interrogation demonstrated high ventricular rates in 9/24 cases with three of these occuring on the date of death. Device data was consistent with cause or mode of death in 9 cases. It was discordant in 4 cases, 3 of these devices did not have EGM storage capability and reported cause of death was fatal arrhythmia. In the fourth no high rates were recorded although a VF arrest was documented in ED.
2/8 ICD interrogations were consistent with cause of death. However 3 were discordant, interrogation revealing no arrhythmia despite the reported cause of death being fatal arrhythmia, suggesting asystole or PEA as the potential fatal arrhythmia.
Conclusion: Post-mortem device interrogation is feasible and useful, providing additional information in 14/32 cases with concordance with cause or mode of death in 11/32.

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Prevalence of Riata lead failure according to lead-specific relative risk among 680 ICD carriers

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Purpose: The problem of premature insulation failure of Riata ICD leads manufactured by St. Jude Medical Inc. is well documented. According to the manufacturer, there is a lead-specific relative risk: Riata 8F single coil leads are regarded as high risk, Riata 8F dual coil and Riata ST 7 F single coil leads are of intermediate risk and Riata ST 7F dual coils carry the lowest risk of lead failure. Aim of this analysis was to evaluate the rate of lead failure between the different Riata lead types at our hospital.
Methods: We performed a single-center retrospective analysis of 680 Riata leads implanted between 03/2002 and 01/2009. These included 39 high risk leads (1572, 1582), 574 intermediate risk leads (1572, 1582, 1570, 1571, 1580, 1581) and 67 low risk leads (7000, 7001, 7040). Patients with lead revision due to dislodgement or infection were excluded from the study. Lead failure was defined as an insulation failure or fracture requiring surgical revision.
Results: During a follow-up time of three years, 111 (16.3%) of the leads had to be replaced, 37 (5.4%) because of pacing/sensing problems and 74 (10.9%) because of lead failure. The distribution of replaced leads among the three risk groups is demonstrated in the table. The median time of lead replacement was 1056 days (IQR 628-1669) after implantation and did not statistically differ between the three groups. Two thirds of the patients presented for routine control (3-6 months), whereas 26% presented with ICD shock, 4% with ICD alarm and 5% with other symptoms such as syncope, bradycardia and muscle twitching. The median time of presentation for these patients was 52 days after the last normal control and did not statistically differ between the three groups.
Conclusions: Ten percent of implanted Riata leads had to be replaced due to lead failure after a median time of 1056 days after first implantation One fourth of these patients presented with an inadaquate schock. Rate of lead failure did not differ between the various Riata groups.

	High risk n = 39	Intermediate risk n = 574	Low risk n = 67	Cohort n = 680
Sensing/pacing problem	3 (8%)	31 (5%)	3 (4%)	37 (5.4%)
Insulation failure or fracture	2 (5%)	67 (12%)	5 (7%)	74 (10.9%)
Days since last normal control	76	49	30	52
Days since implantation	986	1040	1326	1056

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Single centre experience on multi-brand implantable cardioverter-defibrillator (ICD) replacements, what is their real longevity?

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Introduction and objective: Increase in life expectancy of patients with ICD bolds the relevance of choosing ICD with the longest service life. The aim of this study is to assess the average life of different marketed ICD implanted in a single center.
Methods: ICD implanted from January of 1995 to December of 2012 were analyzed. Replacement due to battery depletion was the marker for ICD longevity. Different ICD were analyzed separately: single (V) or dual chamber (D) ICD versus CRT-D; V-ICD and D-ICD were classified together due to the low number of D-ICD in our series and the high percentage of D-ICD programmed as V-ICD. Analysis was also done for companies (Boston Scientific/Guidant, Medtronic and St Jude Medical) and for "old" and "new" ICD (taking 2004 as cut off). Longevity was calculated as the time from ICD implantation to the time of replacement. ANOVA and T-Student analysis were performed taking p value $<$0,05 as statistically significant.
Results: During the study period 192 replacements were analyzed out of 861 implanted ICD in 656 patients (1.3 devices/patient) Age at implant 56.8 $\pm$ 15.6 years, male 85.3%. 20.2% CRT-D. Table
As it is shown in the table Medtronic ICD longevity was better than that of Boston ICD (p = 0,015). St Jude Medical ICD did not show significant difference, probably due to small number of replacements. (p = 0,093).
Longevity of ICD implanted before 2004 was not different than that of ICD implanted after 2004 (6,64 $\pm$ 1,71 vs 5,42 $\pm$ 1,65 years, p = 0,66)
Conclusions: Medtronic ICD longevity was superior to Boston Scientific ICD in our series. The longevity of ICD implanted after 2004, is not better than that of the older ICD, with trend to a shorter service life. The implementation of new diagnostic features may limit the enhancement in longevity. As a limitation, some ICD with long service life have not been already replaced and thus were not include in the analysis. This might influence on the results

	ICD N	Longevity (years)	CRT-D N	Longevity (years)
Boston Scientific/Guidant	105	6,10 $\pm$ 1,72	15	4,52 $\pm$ 0,96
Medtronic	51	6,97 $\pm$ 1,59	1	4,17
St. Jude	15	5,86 $\pm$ 2,14	5	4,62 $\pm$ 1,25
Total	171	6,34 $\pm$ 1,76	21	4,52 $\pm$ 0,98

Results are expressed as mean $\pm$ standard deviation

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Implantable cardioverter defibrillator oversensing in the operating room

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Purpose: Oversensing of extraneous electrical signals by implantable cardioverter defibrillators (ICDs) may occur in the operating room. This can potentially lead to inappropriate delivery of anti-tachycardia therapies. The purpose of this study was to examine the incidence of intraoperative ICD oversensing in a diverse range of surgical procedures.
Methods: From December 1, 2010 to August 1, 2012, all patients with an ICD who required surgery were identified. Surgical procedures below the hips, pacemaker dependent patients, or surgical procedures after 1700h or on weekends were excluded. Pre-operatively, anti-tachycardia therapies were programmed off, but sensing remained enabled as per the patients' usual settings. Post-operatively, the device was interrogated and anti-tachycardia therapies were re-enabled. Two patients underwent cardiac surgery urgently; these devices were not reprogrammed pre-operatively but were interrogated post-operatively.
Results: Thirteen patients were included. Surgical procedures included: craniotomy, cholecystectomy, exploratory laparotomy, lumbar laminectomy (2), transurethral resection of the prostate, transurethral resection of a bladder tumour, open reduction and internal fixation of a distal radius, wide local excision with graft, and coronary artery bypass grafting (4). In the nine patients undergoing non-cardiac surgery, no events were detected. There were 11 intra-operative events detected among three of the patients undergoing cardiac surgery. One episode consisted of sustained electrical noise which was classified by the device as ventricular fibrillation. This episode was of sufficient duration that it would have been treated with a shock had device therapies been enabled. Nine additional episodes of noise were detected and classified by the devices as non-sustained ventricular tachycardia (VT). No therapies would have been delivered. The final episode was true non-sustained VT. The fourth patient undergoing cardiac surgery had 3 short V-V intervals detected during surgery.
Conclusions: Among patients undergoing a diverse range of surgical procedures, patients undergoing cardiac surgery appear to be at high risk of oversensing which could lead to inappropriate device therapy. Non-cardiac surgery appears to pose a lower risk.

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Impact of body mass index on the development of pocket hematoma

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Aims: The aim of this study was to evaluate the impact of Body mass index (BMI) on the development of pocket hematoma related to Cardiovascular implantable Electronic Device (CIED) implantations.
Methods and results: We conducted a retrospective review of 672 patients receiving implantations with CIED between 2008 and 2011 in a tertiary hospital. The patients with pocket hematoma were analyzed to determine the possible predictors of hematoma. Two percent of the population (n = 12) developed severe pocket hematoma. Eighty-three percent of hematoma (n = 10) developed within the first week after the procedure. The mean BMI of the patients with pocket hematoma was 22.8 $\pm$ 3.8 kg/m2. The hematoma rate (6%, n = 6) of patients with BMI $<$22 kg/m2 was significantly higher compared to that of the patients with BMI ^{3}22 kg/m2 (1.06%, n = 6). Pocket hematoma was treated with aggressive external compression and needle drainage. With this approach, pocket evacuation was only performed in 1 case. In multivariate regression analysis, BMI $<$22 kg/m2, dual antiplatelet therapy, complex device, and renal insufficiency ($<$60 ml/min/1.73 m2) were found to be independent predictors of severe pocket hematoma. An decrease of 1 unit in BMI was associated with a roughly sevenfold increase in hematoma formation (OR 7.33, 95% CI 1.79 to 30.08, p = 0.006).
Conclusion: In conclusion, BMI $<$22 kg/m2 was associated with a higher incidence of pocket hematoma. The data supports that effort should be made on careful hemastasis and aggressive external compression of the wound in patients with BMI $<$22 kg/m2.

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Transvenous Lead Extraction in Octagenarians

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Background: As the population ages, the number of elderly patients with cardiac implantable electronic devices is expected to increase as well as the number of patients referred for Transvenous Lead Extraction (TLE). This population, according to recent studies, are affected from multiple comorbidities, and therefore TLE may be at higher risk.
Purpose: Evaluate the safety and efficacy of transvenous lead extraction in octogenarians.
Methods and results: Between 2003 and 2012, we performed 283 TLE procedures in patients because of device infection or malfunction with removal of 591 leads: 83 procedures were performed in elderly subjects (29.3%) with age $\geq$ 80 years (mean age 84 years, range 80-94, 78 males %); 200 procedures were performed in younger subjects (mean age 68 years, range 25-79, 80% males). Device infection was the main indication to TLE, being present in 240 (85%) cases. Compared to younger patients, unexpectedly, octogenarians presented a lower rate of comorbidities such as diabetes (11% vs 22%, P = 0.039), ischemic heart disease (29% vs 44%, P = 0.019), and higher values of left ventricular ejection fraction (47% vs 36%, P $<$0.001). Octogenarians had higher prevalence of COPD. No significant differences between the two groups were found with regard to hypertension and renal failure. The average lead time from implant to extraction was significantly longer in the octogenarians compared to younger group (median 83 months vs 63 months; P = 0.024). Exclusively adopting mechanical technique, were extracted 171 leads in the octogenarians and 420 leads in the younger group. No deaths occurred in the octogenarians group, 1 death occurred among younger subjects. Major complications occurred in 1 patient (1.2%) among the octogenarians and in 2 patients (1%) in the younger group; minor complications occurred rispectively in 13 and in 16 patients (15.6% vs. 7.5%; P = 0.05). Complete procedural success was achieved in 93% (77/83) of octogenarians and in 94.5% (189/200) in the younger subjects. Clinical success (following the latest Heart Rhythm Society consensus document on TLE) was achieved in 100% among octogenarians and in 98.5% in the younger subjects.
Conclusions: Transvenous lead extraction can be performed with safety and efficacy in octogenarians. Procedural and clinical success are equally high in octogenarians and younger subjects. There are no significant differences between the two age groups regard the rate of complications. Minor complications tend to be more frequent in octogenarians.

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Frequency of thrombotic vessel obstruction after pacemaker- or ICD -implantation

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Introduction: Thrombotic vessel alterations(VA) are usually clinically asymptomatic. Within revisions, replacement and system-upgrade pose an operative challenge. Target of the assay was to detect the frequency of VA and to define possible predictors in an unselected consecutive collective.
Methods: 53 patients(P) with severe heart failure were tested using phlebography. The average examination period was 4 $\pm$ 0,7years after the initial operation. The mean EF was 26% $\pm$ 7%. 28 P with VVI-ICD were upgraded to DDD- respectively BIV-ICD, 9 P with DDD-ICD were upgraded to BIV-ICD and 2 P with BIV-ICD were treated due to lead revision. 1 P with VVI-PM was upgraded to DDD-PM, 12 P with DDD-PM on DDD-ICD or BIV-ICD and 1 P with BIV-PM was upgraded to BIV-ICD. The angiographic evaluation was categorized into four groups: I = no vein obstruction(VO), II = VO $<$50%, III = VO $>$50%, IV = vessel occlusion. Regarding the predisposing factors, the association to the number of leads, the patients age and sex, the anticoagulating drugs, and the cardiovascular risk (CVR) were analysed.
Results: 22% of the P (12 out of 53) showed thrombotic VO. The frequency appeared depending on the number of leads: In P with VVI-ICD 10% (3 out of 29) show VO (group II). In P with DDD-ICD or DDD-PM, 33% (3 out of 9, respectively 4 out of 12) showed VO (2 P in group II, 4 P in group III, and 1 P in group IV). In P with BIV ICD, 66% (2 out of 3) showed VO (1 P in group III and 1 P in group IV). The P with BIV-PM didn't present any alterations. P of old age showed an increased incidence of VO (average age: 67y in P without VO versus 76y in P with VO). Regarding the sex, there was no relevant discrepancy (2 out of 10 women = 20 %, 10 out of 43 men = 23 %).The anticoagulation treatment with acetylsalicylic acid (ASA) or Phenprocoumon didn't influence the frequency of thrombotic VA.Concerning the CVR, only the overweight factor showed a relevant higher frequency.
Conclusions: In 22 % of the P, who need a second operation after first-time PM or ICD Implantation, thrombotic VA may occur. At the same time, an incremental number of leads is associated with a higher risk for VA. Anti-coagulating drugs do not decrease the occurrence of VO.

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Safety and efficacy of dabigatran therapy in patients undergoing cardiac rhythm devices interventions

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Background: Safety and efficacy of new oral anticoagulation in patients undergoing pacemaker (PM) or implantable cardioverter-defibrillator (ICD) interventions have not been yet studied.
Here, we present early experience of a high-volume centre with dabigatran in patients with atrial fibrillation undergoing cardiac rhythm devices interventions.
Methods: In 76 consecutive patients (mean age 71 ± 11 years, 68% male, mean CHA2DS2-Vasc score 3.9 ± 1.5) undergoing cardiac rhythm devices interventions the perioperative complications and thromboembolic events were analysed. The patients were treated with 150mg or 110mg dabigatran twice-daily according to creatinine clearance. The anticoagulation was discontinued 12h before and initialised within 48h after the procedure. All procedure related complications and thromboembolic events occurring within 30 days were reported.
Results: 28 (37%) ICD and 48 (63%) PM procedures including 58 (76%) de novo implantations, 9 (12%) generator changes and 9 (12%) systems upgrades were analysed. The mean procedural time was 61 ± 32 min. Most of the patients received dual (36 patients, 37%) as opposed to single chamber systems (23 patients, 30%) and cardiac resynchronization devices (17 patients, 22%). There were two pocket hematomas (3%) and one pneumothorax (1%). No thromboembolic events were noted. The median time to discharge was 2 days [IQR 1-3 day].
Conclusion: The bleeding complications following cardiac rhythm devices interventions under dabigatran therapy are rare. Periinterventional interruption of anticoagulation was not associated with thromboembolic events.

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Use of Transesophageal Echocardiogram in patients undergoing laser lead extraction

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Introduction: The number of patients undergoing lead extraction is increasing over the last decade. Echocardiograms are helpful during the procedure. Use of Transesophageal Echocardiogram (TEE) has been documented in small reports. There are no large reports in the use of peri-procedure TEE
Methods: From a prospective registry at a tertiary referral center from January 2004 to October 2012, 641 patients were studied. All the patients underwent laser lead extraction. All the patients had TEE during the procedure. Clinical outcomes were analyzed. Tricuspid valve function was evaluated before and after the extraction of the leads.
Result: From 641 patients Male was 478(75%), and Female was 163(25%, Age 68 ± 15 years, EF 36 ± 15, NYHA 2.5 ± 1.0, BMI 27.2 ± 6.6. Significant comorbidities were CAD 57%, DM 40%, and Hemodialysis 10.2%. Devices extracted were PM 36.8%, ICD 40.6%, CRT 22.6%. Indication for LLE were infection 65.3%, malfunction 30.6%. An average of 2.0 ± 1.0 leads were extracted per patient, totaling 1305 leads (PM lead 67.2%, ICD lead 31.9%). Procedural success rate was 99.9%. There were 46 laser related adverse events (major 14, minor 33, including 2 deaths). TEE findings helped reveal the presence of: cardiac vegetations in 210 patients, vascular avulsion or tears in 3 patients, cardiac avulsions or tears in 10 patients; pericardial effusion not requiring intervention in 1 patient. Ten patients (1.6%) had large pericardial effusions before starting the procedure. The degree of tricuspid valve insufficiency became less in 96 patients (15.0%) and worsens in none.
Conclusion: TEE was helpful to evaluate tricuspid valve function and to diagnose pericardial effusions and intra-cardiac thrombus or vegetations

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Pocket infections treated by negative pressure wound therapy

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Purpose: Cardiac implantable electronic device (CIED) infections are increasingly common as the number of device implants increases. Management of CIED infection is frequently challenging and requires prolonged hospitalization. Traditionally, after CIED removal and debridement of an infected pocket, the wound can either be treated with a drain or allowed to heal by delayed primary closure. Negative pressure wound therapy (NPWT) has been used to promote the healing of a wide variety of surgical wounds, but has not been reported in the treatment CIED infections. Here we describe the first series of patients in which NPWT was successfully used to treat CIED pocket infections.
Methods and results: Infected CIEDs and leads were extracted in 23 patients with pocket infections. After debridement, the wound was packed with a GranuFoamTM sponge and a drainage tube was inserted under an occlusive dressing. The tube was connected to a WoundVac™ (WV) device and negative pressure of 125 mm Hg continuously applied. The WV was left in place for a median of 5 days (range 2-15 days), and drained an average of 220 ml serosanguineous fluid (range 35-600 ml). After removal of the WV, the pocket was closed loosely with 1-0 prolene mattress sutures and allowed to heal by delayed primary closure. All infected pockets healed without complications and without evidence of recurrent infection over a median follow-up of 43 days (range 10 – 370 days). The median length of stay after CIED extraction was 9 days (range 2-26 days). Re-implantation of a CIED in the contralateral hemithorax was performed a median of 15 days after extraction (range 3 – 55 days). One patient developed recurrent infection when a new device was implanted at the same site 2 weeks after extraction. A second patient who continued to abuse IV drugs developed re-infection of the new CIED leads four months after initial extraction.
Conclusions: This is the first report of the use of negative pressure wound therapy (NPWT) in the treatment of CIED pocket infections. We found that NPWT was a safe and effective means to promote healing of infected pockets with a low incidence of recurrent infection.

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Influence of remote monitoring systems on prognosis in an unselected population of ICD recipients

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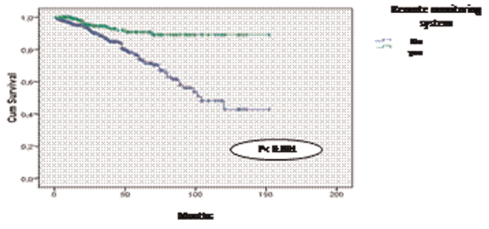
Purpose: Remote cardiac monitoring (RCM) is a new and emerging tool that supports in the aftercare follow-up of ICD- implanted patients, although there is still limited evidence on direct patient benefits.
Methods: We conducted a retrospective study of ICD carriers implanted at our institution since 2004 by collecting clinical data and their outcome. Those who have adequate support were trained in the use of telemonitoring devices since these became available.
Results: Atotal of 696 ICD patients (age: 61 ± 13 years, 18% female, baseline EF: 31%, 69% in primary prevention; 25% CRT- D, 59% ischemic, 24% NYHA III-IV) were included. 45% of them were followed by a RCM system at home. After a mean follow-up of 33 ± 28 months, patients with RCM systems suffered less MACE (death, heart transplantation or heart failure hospitalizations; 27% vs 7.5%, p <0.001). Remote monitoring was identified as an independent factor of better clinical outcome (OR: 0.19, 95% CI 0.13 to 0.24; p< 0,001).
Conclusions: Cardiac remote monitoring systems seem to improve the prognosis in implantable cardioverter defibrillator- implanted patients.



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Mid-long term follow-up of patients submitted to Percutaneous Lead Extraction (PLE): a single centre experience

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New guidelines have widened the indication to PLE. As a result, the number of patients (pts) who undergo this procedure is continuously growing. Recently some studies have reported the long - term survival of pts submitted to PLE, especially in pts who underwent PLE for infection of the pacing/ICD system.
Aim of our study was to verify is there is a difference in survival between pts who undergo PLE for infection or for other reasons (malfunctioning/venous occlusion).
Since January 2010 to December 2012, 90 pts underwent PLE at our Centre (65 male, 72.2%; mean age 66 $\pm$ 14 yrs, range 25 - 87). 61 pts (67.8%) underwent PLE for infection, 29 for "non infective" reasons (31.2%; 27 malfunctioning leads). PLE was attempted in 190 leads and was successful in 173 leads (91%; 168 complete success, 5 clinical success); 16 leads were sent to the surgeon and 1 malfunctioning lead was abandoned (failure 9%). No major complications were observed; 2 pts (2.2%) had minor complications (1 artero-venous femoral fistula; 1 partial tricuspidal valve leaflet avulsion).
Survival rate at 1 and 2 years respectively was 96% and 94%, but with a significant difference amongst the two groups: "infective" pts had survival rate of 94.5% and 85.8% at 1 and years whilst all "non infective" pts were alive at two years ($p = .02$).
Furthermore, amongst infective pts we observed a statistically significant difference in pts with and without vegetations over the lead or the valve. Survival rates at 1 and 2 years respectively were 94.1% and 90.4% in pts without vegetations and 71.3% and 46.8% in pts with vegetations. Presence of vegetations remained the only variable related to worst outcome even in a multivariate analysis.
Pts with vegetation were older in comparison to those without vegetations (69 $\pm$ 10 yrs vs 65 $\pm$ 15 yrs, $p = 0.05$) and they had a longer implant time (60 $\pm$ 16 vs $\pm$ 36 $\pm$ 18 months).
Our data, even if derived from a small number of pts, demonstrate that PLE is an effective and safe procedure. PLE allows a significant improvement of survival in infective pts, provided that it is performed before the appearance of systemic signs of infection (mainly vegetations).

P260

Impact of the Advisa MRI SureScan pacing system on the diagnostic quality of cardiac magnetic resonance images and contraction patterns of cardiac muscle tissue during scans

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Background: The Advisa MRI SureScan Pacing System is an MR conditional pacing system designed to safely undergo magnetic resonance image (MRI) scans. Its influence on image quality, particularly of cardiac MR (CMR) acquisitions, is not well known. The Advisa MRI Study evaluated the CMR image quality and characterized the myocardial contraction patterns.
Methods: In this international trial with 35 participating centers, 269 patients were enrolled and an Advisa MRI System was implanted in 263 patients. Of those, 177 were randomized to the MRI group and 150 underwent MRI scans at the 9-12 week visit. Left ventricular (LV) and right ventricular (RV) cine long-axis steady-state free precession (SSFP) MR images were graded for quality. Signal loss along the implantable pulse generator and leads was also measured. The tagging CMR data quality was assessed as the percentage of trackable tagging points on CSPAMM (complementary spatial modulation of magnetization) acquisitions ($n = 16$) and segmental circumferential fiber shortening was quantified.
Results: Of all cine long-axis SSFP acquisitions, 95% of the LV and 98% of the RV acquisitions were of diagnostic quality, with 84% and 93% respectively being of good or excellent quality. Tagging points were trackable from systole into early diastole (360-648 ms after the R wave) in all segments. During RV pacing, tagging demonstrated a dyssynchronous contraction pattern, which was not observed in non-paced ($n = 4$) and
right atrial-paced ($n = 8$) patients.
Conclusions: In the Advisa MRI Study, high quality CMR images for the assessment of cardiac anatomy and function were obtained in patients with an implantable pacing system. In addition, this study demonstrated the feasibility of acquiring tagging data to study the LV function during pacing.

P261

Transvenous removal of icd leads: riata vs sprint fidelis

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Introduction: Sprint Fidelis (S) and Riata (R) ICD leads were recalled by the Food and Drug Administration because of an increased rate of failure due to conductor fracture (S) or insulation abrasion (R). Treatment options include intensifying monitoring and intervening replacing recalled lead, with or without extraction. However, because of its mechanical separation, R leads may be challenging to extract. Aim of this study is a comparison between S and R lead extraction.
Methods: since January 1997 to June 2012, we managed 513 consecutive patients with 545 ventricular ICD leads; among these, 45 were S and 94 R. There were no significative difference in patients and lead characteristics in the two groups. Indications to removal were infective in the majority of cases (73%). Mean pacing period was 39.1 + -22.1 months in S group and 36.1 + -23.4 months in R group. 91% of ICD leads in both groups were dual coil. In case of manual traction failure, we performed mechanical dilatation using a single polypropylene sheath technique (Cook Vascular - Leechburg PA, USA) and if necessary, other intravascular tools (Catchers and Lassos, Osypka, Grentzig-Whylen, G); an Approach through the Internal Jugular Vein (JA) was performed in case of failure of the standard approach.
Results: Success rate was achieved in all 45 (100%) S leads and in 93/94 (98.9%) R leads. No major complications occurred. Manual traction effectiveness was higher in S leads (9 vs 2%) while JA was required more frequently in R leads (8 vs 2%) ($p < 0.01$). Extraction time and mean sheath size used were significantly higher in R group. Comparing binding sites locations, R leads exhibited higher incidence in superior vena cava, right atrium and tricuspid valve as compared to S leads ($p < 0.01$). In R group presence of cable externalization was a predictor of difficult procedure and need for JA.
Conclusions: our experience shows that the extraction of recalled S and R ICD leads is feasible and effective. However, extraction of R leads is more complex than F leads. Lack of coil backfilling and cable externalization in R group may account for these differences. The decision to extract or not to extract R leads should be individualized.

P262

A comparison between lead extraction results using 80 Hz and 40 Hz laser-powered sheaths

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Background: Lead extraction is a technically demanding and potentially hazardous procedure. Eighty Hertz (Hz) laser-powered sheath is new technology that facilitates lead extraction. Comparative studies are needed to evaluate the efficacy and safety of 80 Hz laser-powered lead extraction sheath.
Methods: We compared the results of lead extraction using 80 Hz laser-powered sheaths done during the period from 1st of January 2012 to 31st of December 2012 (Group A: number = 75; age = 67.1 years $\pm$ 13.4; female = 17.7%; leads number = 114; leads age = 103.3 $\pm$ 67.2 months) with those done using 40Hz laser-powered sheath during the period from 1st of January 2011 to 31st of December 2012 (Group B; number = 59, age = 71.4 $\pm$ 11.5 years; female = 27.1%; leads number = 91, lead age = 93.2 $\pm$ 60.6 months) Efficacy endpoints were complete and partial success rates and laser irrigation time. Safety endpoints were procedure-related complications and mortality.
Results: Complete and partial success rates were 96% and1.3% in group A vs. 98.3% and 1.6% in group B; ($p = 0.63$ and $p = 1$), respectively. Failure rate was 2.6% in group A ($n = 2$) vs. zero% in group B ($p = 0.508$). Mean laser irrigation time was 29.84 $\pm$ 38.19 in group A vs. 26.39 $\pm$ 26.64 seconds in group B ($p = 0.466$). Complication rate was 2.6% in group A vs. zero% in group B ($p = 0.508$). No procedure-related mortalities occurred in both groups.
Conclusion: There were no significant diferrences between 80 Hz and 40 Hz laser-powered sheaths concerning efficacy and safety. In the preliminary data analysis, the number of laser deliveries seems lower in the 80 Hz group.

P263

Evaluation of same-day home discharge after cardiac pacing devices implantation

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Purpose: Due to the increase of the established indications in the clinical guidelines the number of implanted cardiac pacing devices is growing, with the costs this entails.Our aim is to assess the safety and feasibility of a program of early discharge after a device implantation.
Methods: A retrospective study of consecutive patients who underwent an elective implantation of a pacing device between August 2011 and March 2012 was performed. We compared the outcome of those who followed the conventional strategy (24h hospitalization) versus those with early discharge (4- 6 h after uncomplicated procedure) when this became available.
Results: A total of 168 patients were included (65,8 ± 15,3 years, 35,7% females). The percentaje of VVI pacemakers was 21,4% , DDD were 30.4%, and 3% of CRT-P. The rest were ICD devices (14.2% CRT-D, 28% monocameral ICD and 3% bicameral ICD). 57,7% of patients were managed by early discharge strategy. After a mean follow-up of 2.7 ± 0.8 months, the following complications were registered: pneumothorax (0.6%), heart failure decompensation (0.6%), contrast nephropathy (0.6%), pocket infection (0.6%) and electrode dislocation (4.2%). There were no significant differences in the occurrence of complications between both groups (conventional Vs early discharge) (7% vs. 6.2%, P 0.82)
Conclusions: The incidence of complications after implantation of cardiac pacing devices in our series was low. These data also suggest that same-day discharge after an uncomplicated procedure is safe and may be applicable in clinical practice.

P264

Extrathoracic subclavian vein puntcure without contrast venography for pacemaker and defibrillator leads implantation

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Purpose: Extrathoracic Subclavian Vein Puncture has been demonstrated to be an effective method for pacemaker and defibrillator leads implantation, without the complications encountered with the standard intrathoracic approach.
Different techniques have been adopted for the cannulation of the extrathoracic subclavian vein. We report our experience using as fluoroscopic land mark the outer edge of the 1st rib below the inferior border of the clavicle.
Method: A subcutaneous pocket is created 1 cm medially and parallel to the delto-pectoral groove and 2 cm below the clavicle. A 18 gauge needle from the upper border of the pocket is directed perpendicularly to the outer edge of the 1st rib just below the inferior border of the clavicle. If the vein is not entered the needle is withdrawn and the puncture is repeated with slight variation of needle direction for a maximum of 4-5 times, then contrast guided vein puncture is performed. Upon successful vein puncture a guide wire is inserted and positioned in the superior vena cava. The remainder of the implantation is carried out in a routine manner.
Resuts: The extrathoracic subclavian vein was successfully cannulated in 172 of 182 consecutive patients (94.5%); the vein could not be found in 10 patients (5.5%): in these patients the vein was successfully cannulated after venography performance. No pneumothorax, hemothoracs or brachial plexus injury occurred.
Conclusions: Our approach of extrathoracic subclavian venipunture using fluoroscopic landmark, without contrast venography, is simple, safe and effective.

P265

Follow up of phrenic nerve stimulation measurements in quadripolar left ventricular lead implanted patients

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Purpose: The aim of this analysis is to describe the evolution of Phrenic Nerve Stimulation (PNS) threshold performance of the quadripolar LV lead over 6 months of follow up, and to assess the ability of this lead to resolve PNS-related lead repositioning or re-intervention.
Methods: HF patients in sinus rhythm underwent CRT-D device implantation with the quadripolar LV lead at 6 investigational sites. Data were collected within 7 days of implant and at 6 month post-implant. PNS thresholds were assessed during Bi-V pacing from all 10 LV pacing vectors: 3 traditional configurations (Tip-Ring; Tip-RVC; Ring-RVC) and 7 non-traditional vectors unique to this quadripolar lead. PNS was considered present when the PNS threshold was < 7.5V.
Results: 51 patients (66.5 years, 71% male, 61% NYHA III, mean EF of 25.3%, and baseline QRS of 169ms) were included in the study. 49 of these patients were followed for 6 months and are included in this analysis.
See table 1. Non Traditional pacing vectors exhibited a lower rate of PNS than Traditional vectors, both at enrollment (p = 0.001) and after 6 months (p = 0.0045). In addition, the incidence of PNS remained stable over time both in traditional and non-traditional vectors.
At 6 months, 7/51 patients (14%) exhibited PNS in all traditional vectors. 5 of these 7 patients could be paced with a non-traditional vector free of PNS. In these 5 cases, the quadripolar lead provided a mean of 4.8 PNS-free alternative vectors per patient, and a mean of 2.8 PNS-free alternative vectors with a capture threshold <3V.
Conclusion: The incidence of PNS elicited by LV pacing vectors unique to the quadripolar LV lead was lower than that with Traditional bipolar-lead-based vectors. These results were stable over a 6 month follow up period. The availability of a broader range of pacing vectors available in this quadripolar LV lead may avoid re-interventions due to PNS.

	Enrollment			6 Month FU		
	Number of vectors tested	Vectors with PNS		Number of vectors tested	Vectors with PNS	
Traditional vectors	153	51	33% *1	147	49	33% *2
Non Traditional vectors	357	68	19% *1	343	69	20% *2
Total	510	119	23%	490	118	24%

Table 1. Distribution of PNS over LV pacing vectors.*1 : p = 0.001 ; *2 : p = 0.0045.

P266

Deterioration of left ventricular (LV) systolic function in patients (PTS) treated with antibradycardic pacemakers (PM) and rightventricular (RV) stimulation: is it a clinically relevant problem?

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Purpose: RV pacing may lead to asynchronous contraction, systolic dysfunction, and heart failure. Not much is known about the incidence in PTS treated with PM for standard anti-bradycardic indications.
Methods: Echocardiographic evaluation (ECHO) of a large cohort of PTS with standard PM indications at the time of PM implantation and after a follow-up (FU) period of > 2 months.
Results: From 2005-2009 1759 PTS were treated with a PM for symptomatic bradycardia at our institution. PTS with primary CRT- and/or ICD-indications were excluded. 1214/1759 PTS (53% male, mean age 74 yrs; a-v-block 51%, group A; sinus node disease 40 %, group B) had an ECHO at the time of implantation and after a mean FU of 3,3 yrs (0.3-7,9yrs). Of 838 PTS with a normal systolic LV function (EF > 55%) at implant 84% still had a preserved LV-function at last FU. Only 37 PTS (4,4%) had an EF <46% (mean 38%), while 11,6% had a small reduction of EF to mean 48%. 25/1214 PTS (2.1%) developed severe heart failure (≥NYHA 3) and were upgraded to biventricular pacing, the incidence was 1,1% (9/838) in PTS with an initial EF >55%. The overall risk for adverse remodeling was significantly higher in group A (6,1% vs. 2,3% in group B).
Conclusions: In an "everyday-PM-population" the development of severe systolic dysfunction is a relatively rare event, when there is a normal global LV function at the time of implantation, even in PTS with predominant RV pacing during FU (group A). Thus prophylactic implantation of a CS electrode to enable biventricular stimulation is not recommendable.

Resynchronisation therapy

P267

Discrepancy between echocardiographic and patient-reported CRT response: results of the PSYHEART-CRT study

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Purpose: Left ventricular (LV) reverse remodelling is an important measure of the efficacy of cardiac resynchronization therapy (CRT). However, clinical practice shows that this echocardiographic response does not always infer an improvement in patient-perceived symptoms, function and quality of life. The aim of the current study is to get more insight into the association between echocardiographic CRT response and patient-reported health status improvement in the first 6 months of CRT.
Methods: Consecutively implanted CRT-defibrillator patients (N = 109;mean age = 65.4 ± 10.1;35 women) were recruited from the University Medical Center Utrecht, the Netherlands. Patients participated in the prospective 'The influence of PSYchological factors on health outcomes in HEART failure patients treated with CRT'; (PSYHEART-CRT) study. All patients completed the Kansas City Cardiomyopathy Questionnaire (KCCQ) at the time of implantation and 6 months later. An absolute increase of ≥10 points on the KCCQ overall summary score was used to represent clinically relevant improvement in HF-specific health status. Echocardiographic response was defined based on reverse remodelling: ≥15% reduction in LV end-systolic volume after 6 months of CRT.
Results: Of all patients, 58(53%) showed an echocardiographic CRT response. Of these responders, 25(43%) did not report health status improvement, while only 33(53%) of the 62 patients reporting better health status showed an echocardiographic response. The c-statistic (0.50) and logistic regression result (OR = 1.79,95%CI = 0.48-6.68, adjusted for age, sex, pre-implantation KCCQ score, NYHA functional class, QRS duration, ejection fraction, left bundle branch block, ischemic etiology, comorbidities, and defibrillator shocks) confirmed that echocardiographic response was not associated with a ≥10 point improvement in KCCQ score. Regarding the covariates, only pre-implantation KCCQ score (OR = 0.91,95%CI = 0.87-0.95) and QRS duration (OR = 1.03,95% CI = 1.01-1.07) were associated with health status improvement.
Conclusions: Our results show a large discrepancy between echocardiographic CRT response and improvement in patient-reported health status in the first 6 months of CRT. This emphasizes that health status measures have additional value over traditional measures in assessing response to CRT from the patient's perspective. The question remains which demographic, clinical and psychological factors may explain the discrepancy between objective and patient-reported indicators of CRT response. Such knowledge may help with respect to further risk stratification and secondary intervention.

P268

Impact of atrial fibrillation-related inappropriate shocks on clinical outcome in heart failure patients treated with cardiac resynchronization therapy defibrillators

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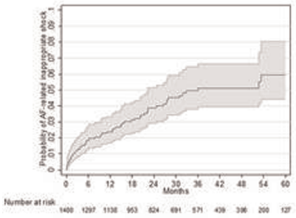
Introduction: Patients (pts) with implantable defibrillators (ICD), atrial fibrillation (AF) may worsen prognosis due to inappropriate ICD shocks. We aimed to assess incidence, causes and impact of inappropriate ICD shocks on clinical outcome in heart failure (HF) pts implanted with biventricular defibrillators (CRT-D).
Methods: 1404 CRT-ICD pts were prospectively followed in 74 Italian cardiologies. Device diagnostics enabled the occurrence and treatment of atrial and ventricular tachyarrhythmias to be evaluated. All episodes detected as VT/VF were reviewed by expert electrophysiologists, who classified appropriate and inappropriate detection.
Results: In a median follow-up of 31 months, AF > 10 minutes occurred in 556 pts (40%) and VT/VF in 511 (36%). Inappropriate VT/VF detections occurred in 232 (16%), inappropriate shocks occurred in 101 pts. AF was the cause of inappropriate shocks in 60 pts: 4% of the whole population and 59% of pts with inappropriate shocks. AF caused 144 inappropriate shocks -53% of all inappropriate shocks. The likelihood of experiencing one or more AF-related inappropriate shocks was 2.4%, 4% and 5% at 1, 2 and 3 years, respectively (figure). According to Cox analysis, both death and endpoint composed of HF hospitalization or death, were not correlated with shocks due to any cause, appropriate shocks, inappropriate shocks or AF-related inappropriate shocks.
Conclusions: AF is a major cause of inappropriate shocks, constituting the mechanism of inappropriate detection in 59% of pts with inappropriate shocks and in 53% of episodes with inappropriate shocks. Appropriate or inappropriate shocks did not correlate with death nor with the endpoint composed of HF hospitalization or death.



P269

Comparison of the change of intrinsic AV intervals with increased heart rate associated with atrial pacing between chronotropic competent and incompetent patients: results of the RAVE study

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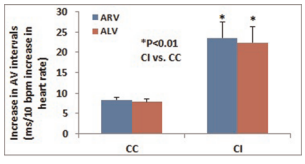
Purpose: The programmed AV delay is important in cardiac resynchronization therapy (CRT) to maintain biventricular pacing and optimize the hemodynamic response. Typically the AV delay is measured at rest and is based on intrinsic AV intervals in several electrogram based AV optimization (AVO) algorithms. Little is known regarding the effect of atrial pacing rate or exercise on intrinsic AV intervals.
Methods: RAVE was a multicenter study of 36 CRT patients in sinus rhythm. Heart rate (HR) was increased with both submaximal exercise and with incremental atrial pacing (AP) up to 130 beats/min (bpm) for each patient. Atrial to right ventricular (ARV) and atrial to left ventricular (ALV) time intervals were measured at multiple heart rates in the absence of ventricular pacing. Chonotropic incompetence (CI) was defined as a maximal HR achieved during the sub maximal exercise test < 100 bpm or 75% of 85% of age predicted max HR.
Results: The patient population was 72% male with a mean age of 65 ± 10 years old. The mean EF was 29 ± 12 and 52% had mild HF (NYHA I/II) at the time of testing. ARV and ALV intervals increased with incremental atrial pacing for both chronotropic competent (CC) and CI patients (Figure). However, the change in the ARV and ALV intervals were about 3-fold greater in CI patients.
Conclusions: Patients with CI have significant prolongation of AV intervals with increased atrial pacing rates, suggesting that AV delays may need to be adjusted for different atrial pacing rates in this cohort who often require such pacing. In addition, the AV response to overdrive atrial pacing may provide a simple means of identifying chronotropic competence in CRT patients.



P270

Follow up of capture threshold measurements in quartet lead implanted patients

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Purpose: The purpose of this analysis is to describe the evolution of capture thresholds over 6 months of follow up in consecutive CRT patients implanted with a quadripolar LV lead.
Methods: HF patients in sinus rhythm and ≥ 18 years old underwent CRT-D device implantation with a quadripolar LV lead at 6 investigational sites. Data were collected within 7 days of implant and at 6 month post-implant. Capture thresholds were assessed during Bi-V pacing (with a pulse width of 0.4ms) from all 10 LV pacing vectors: 3 traditional configurations (Tip-Ring; Tip-RVC; Ring-RVC) and up to 7 non traditional vectors unique to the quadripolar lead.
Results: 51 patients (average age 66.5 years, 71% male, 76% with non-ischemic heart disease, 61% NYHA III, mean EF of 25.3%, and mean baseline QRS of 169ms) were included in the study. 49 of these patients were followed for 6 months and are included in this analysis. Capture thresholds remained within the acceptable range both at enrollment and after 6 months. A small clinically insignificant increase was observed at 6 months. Minimal capture thresholds were obtained when considering all the configurations available in the quadripolar lead, allowing the selection of the lowest capture threshold available in each patient over the follow up period.
Conclusion: Capture thresholds obtained from traditional and non-traditional configurations of the Quartet lead were good both at enrollment and after 6 months follow up, suggesting that all four electrodes of this quadripolar lead maintain good intimate contact with the myocardium in all four electrodes. The nontraditional LV pacing vectors unique to this quadripolar lead should be considered as viable pacing vector alternatives for CRT patients from the clinical point of view.

	Enrollment		6 Month FU	
	Number of configurations evaluated	Best Capture Threshold mean(V)	Number of configurations evaluated	Best Capture Threshold mean (V)
Traditional vectors	146	0.79 + 0.47 *1	141	0.96 + 0.54 *1
Non Traditional vectors	294	0.97 + 0.55 *2	274	1.21 + 0.47 *2
All quadripolar available vectors	440	0.72 + 0.32 *3	415	0.90 + 0.41 *3

Evolution of the capture thresholds over 6 months follow up. *1 : p = 0.0046 ; *2 : p = 0.0095; *3 : p = 0.0013

P271

CRT therapy in IABP dependent heart failure patients

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Background: The intraaortic balloon pump (IABP) support on intensive care unit in case of decompensated heart failure makes possible further therapeutic options.
Aim: The short – and long term observation of the outcome of resynchronisation therapy in patients with proved ventricular asynchrony (QRS >130 msec, LBBB pattern) and IABP support due to catecholamine -resistant heart failure.
Method: 6 patients with IABP support (1 congenitally corrected Transposition of the Great Arteries [ccTGGA], 1 critical aortic valve stenosis, 2 ischaemic cardiomyopathy [CMP], 2 dilated CMP) underwent resynchronisation therapy.
Results: The median time between IABP implantation and resynchronisation therapy was 22 days (interquartile range [IQR] 10-38). The left ventricular electrode implantation (5 lateral, 1 anterolateral position) was successful in every patient. Median procedure and fluoroscopy times measured 57,5 minutes (IQR 40-90) and 5,8 minutes (IQR 4-22,7). There was no therapy-related adverse event. The IABP support could be stopped after a median of 14 days (IQR 2-36) in every case. 5 out of 6 patients (83 %) acutely responded by improvement of hemodynamic parameters with simultaneous reduction of catecholamine support. The control post-implantation echocardiography examination detected a median of 10 % improvement in ejection fraction; however in 1 case significant improvement in ejection fraction could not be reached. The QRS width was shortened from median of 179 msec (IQR 124-188) to 142 msec (IQR 112-174). The 6 months follow- up revealed 4 out of 6 patients in NYHA II functional status. 1 patient 30 days after IABP explantation underwent transcatheter aortic valve implantation, 1 patient was referred to heart transplantation.
Conclusions: The CRT implantation due to non-corrected ventricular asynchrony (QRS >150 msec) is a safety therapy parallel with IABP support, ensuring hemodynamic stability, making possible the explantation of the IABP support.

P272

Is there any alternative for patients in NYHA III heart failure and low ejection fraction not qualified for CRT?

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Background: There is large borderline group of patients with EF < 35%, heart failure in NYHA III class and QRS < 120ms, who are not qualified to CRT. They are treated with implanted cardioverter-defibrillator (ICD) and standard pharmacotherapy.
Aim: Comparison of outcomes of rehabilitation of patients in NYHA III heart failure and patients with implanted CRT-D device and no rehabilitation.
Methods: The study included 20 patients with ICD + rehabilitation and 27 patients with CRT−D only. Patients with ICD went through the training program (aerobic exercises on ergometer, 3 times a week for 3 months). Patients with CRT-D were treated pharmacologically. All patients had echocardiography and cardiopulmonary exercise test (CPX) done before the enrollment to the study and after 6 months.
Results: See table 1.
Conclusions: Rehabilitated patients with NYHA III heart failure have better results when compared with CRT group. Rehabilitation is a noteworthy therapy for borderline patients with no indications to CRT.

		CRT, no rehabilitation	ICD and rehabilitation	Statistical significance (p)
Age [years]		64,9 ± 8,2	61,8 ± 11,2	Ns
BMI [kg/m^2]		27,7 ± 4,7	27,6 ± 3,8	Ns
EF [%]	Before	24,4 ± 8,0	25,4 ± 5,4	Ns
	After	28,8 ± 10,4	31,3 ± 9,1	Ns
		0,0729 (ns)	0,0013	
LVdD [cm]	Before	6,9 ± 1,1	6,3 ± 0,8	0,0510
	After	6,5 ± 0,6	6,0 ± 0,6	0,0169
		0,0464	0,0124	
LVsD [cm]	Before	5,36 ± 1,0	4,8 ± 1,0	Ns
	After	4,69 ± 0,78	4,15 ± 0,73	0,0390
		0,0052	0,0033	
Peak oxygen uptake (VO_2) [ml]	Before	10,9 ± 3,8	13,3 ± 4,6	0,0613
	After	11,9 ± 4,0	15,7 ± 5,9	0,0144
		ns	0,0168	

BMI - body mass indexEF - ejection fractionLVdD - lef ventricle diastolic diameterLVsD - left ventricle systolic diameter

P273

Short electrode spacing on left ventricular quadripolar leads enables a targeted LV site pacing for CRT despite phrenic nerve stimulation

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Introduction: Phrenic Nerve Stimulation (PNS) is a limiting factor for a targeted left ventricular (LV) pacing from coronary veins, occurring in 5 to 25% of CRT patients. PNS may be avoided by electronic repositioning from the phrenic nerve (PN). A novel LV quadripolar lead includes 4 electrodes with a short electrode spacing (1.3 mm) dipole and two conventional electrode spacing (21mm) dipoles. The short electrode spacing dipole allows pacing the target LV site that may be close to PN and provides greater flexibility.
Methods: Fourteen canines have been acutely studied for evaluating PNS and cardiac pacing of the LV lead. The canines were implanted with the LV lead in the coronary veins and an ICD lead (Sprint Quattro®, Medtronic) in RV. The PN was surgically moved next to the short dipole to induce PNS in the study. Three of 14 canines were studied for 12 weeks after the lead implant. PNS and Cardiac pacing thresholds, pacing impedance, and R-wave were measured at a variety of programmed configurations.
Results: The acute and chronic canine studies demonstrated a 2-3 fold increase in PNS thresholds with the short electrode spacing dipole in comparison to the other conventional bipolar configuration as shown in the figure below. The PN remained intact and was not damaged by the relocation as assessed during gross pathology and histopathology at 12 weeks.
Conclusions: The Medtronic LV quadripolar lead provides two viable alternatives to avoid PNS: 1) Electronic repositioning moves the pacing electrode away from PN; 2) use of the short electrode spacing dipole increases PNS threshold while maintaining pacing threshold at a target pacing site.

P274

Offline clinical performance of a hybrid left ventricular autothreshold technology in a clinic follow-up setting

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Purpose: The hybrid Left Ventricular Autothreshold (LVAT) technology consists of an independent pace/sense (IPS) method, in which evoked response (ER) is sensed from one electrode when the other is used for pacing in bipolar LV leads (for unipolar vectors), and a shared cathode sensing method (SCS), in which the same cathode is used for pacing as well as sensing ER (for bipolar vectors). Previous clinical studies have demonstrated that the IPS method worked with high accuracy.
The objective of this analysis is to evaluate the performance of the hybrid LVAT technology for CRT devices with bipolar leads.
Methods: Data from phase 2 and 3 of the ELEVATE study were pooled. In both phases, patients with CRT-D devices (BSC, MN, USA) were enrolled and a programmer with custom software performed step-down threshold (thr) tests. In phase 2, ER from 4 pacing vectors were collected using IPS, and in phase 3, ER from the 2 pacing vectors were collected using SCS. For every test, thr was determined by observing changes in the surface ECG (gold standard (GS)). The LVAT algorithm ran offline to determine the thr. Accuracy was defined as absolute difference between algorithm and GS thr within two voltage steps.
Results: Data from 144 patients (95 with IPS and 39 with SCS) were analyzed. Bipolar LV leads from 3 major manufacturers were used. Results are summarized in the table. None of the step-down pacing tests resulted in a thr lower than the GS-determined thr.
Conclusion: In this study, the offline LVAT algorithm and GS had a high overall agreement (over 99%) suggesting that the LVAT algorithm is accurate at determining pacing thr in multiple pacing configurations and a wide range of LV leads in CRT patients.

Method	No. of tests, N	Too many intrinsic beats during the test, N	Number of tests that resulted in an expected LVAT output, N (%)	number of tests that resulted in threshold measurement, N	Threshold accuracy, N(%)
IPS	721	10	668 (94%)	642	641 (99.8%)
SCS	228	11	178 (82%)	177	175 (98.9%)

P275

Loss of continuous biventricular pacing in cardiac resynchronization therapy patients: incidence, causes and outcomes

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Introduction and objectives: In recent years there has been a significant increase in the number of implanted cardiac devices with cardiac resynchronization therapy. The benefits obtained with such a therapy are directly related to the maintenance of continuous biventricular pacing. The study analyzes the incidence, causes, attitude and outcomes for the loss of continuous biventricular pacing.
Methods: Clinical and follow-up data of a series of consecutive patients from a single centre in which a cardiac resynchronization therapy device was implanted were analyzed.
Results: The study included 136 patients. During a mean follow-up of 33,4 months, 45 patients (33%) experienced loss of continuous biventricular pacing. Main causes included atrial tachyarrhythmias (21,3%), lead macrodislodgement (18%) and loss of left ventricular capture (13,1%). Loss of continuous biventricular pacing was mainly transient and correctable (88,5 of cases) and it occurred earlier during follow-up when either lead macrodislodgement, oversensing or extracardiac stimulation were the cause. There were no significant differences in mortality between the groups of patients with and without loss of continuous biventricular pacing ($p = 0,88$).
Conclusions: Despite technical advances in cardiac resynchronization therapy, loss of continuous biventricular pacing is a common clinical situation but it is frequently correctable. A close monitoring and follow-up of the patients and a proactive approach ensure the achievement of continuous biventricular pacing for the majority of patients.

P276

Using surface ECG for cardiac resynchronization therapy optimization

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Background: Atrioventricular and interventricular delay (VVD) optimization is an important part of CRT correction. The lack of this procedure or incorrect performance may reduce the positive effect of cardiac resynchronization and enhance heart failure (HF). Widely used selection of VVD methods with different ways of echocardiography requires special skills and time-consuming.
Aim: To assess the impact of VVD optimization in CRT devices based on changes in the width of the QRS complex using ECG on intracardiac hemodynamic parameters in the long-term period.
Materials and methods: 88 patients after CRT implantation were divided into 2 groups (I - with selection of VVD, n = 49, II - without selection of VVD, n = 39) with sinus rhythm, complete left bundle branch block, ejection fraction (EF) $\leq$35%.QRS complex was measured before CRT implantation (QRSown), then every 6 months: QRS measurement in the temporary device suppression mode (QRSno-st), measuring the width of the stimulated QRS complex (QRSst) during the VVD optimization process. VVD selection was implemented by gradual change the delay time of stimulation of the right/left ventricle (from 0 to 40 ms) and simultaneous measurement of the stimulated QRS width on ECG. The final VVD result was assumed to the narrowest QRS. Echocardiography was performed in all patients before CRT implantation and then every 6 months. Observation period was 2 years.
Results: For 24 month follow-up there was significant reducion in the QRSst width in Group I, $p = 0.042$. Final values of the QRSst and QRSno-st width were lower in Group I, $p = 0.015$ and $p = 0.001$ respectively. There are no significant differences in baseline QRS and QRSst between the groups. End-systolic and end-diastolic LV volume significantly decreased in both groups; reduction in the end-systolic volume was greater in Group I compared to Group II, $p = 0.039$. EF increased in both groups; percentage increase in EF was significantly higher in Group I, $p = 0.048$. Functional class (FC) of HF decreased in both groups; the final FC value was significantly lower in Group I, 2.12 versus 2.64 in Group II, $p = 0.001$.
Conclusions: VVD optimization in CRT devices using surface ECG influences on hemodynamic parameters in the long-term period. The narrowest QRS can be the sign of optimal cardiac synchronization. This safe and reproducible method improves the electrical systole of the myocardium and can adjust the conduction system of ventricles that leads subsequently to a decrease in FC of HF.

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Does left atrial early negative strain predict outcome after cardiac resynchronization therapy?

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Background and objectives: There is a lack of data in the literature regarding the left atrial (LA) longitudinal strain (ε) as predictor of prognosis in patients undergoing cardiac resynchronization therapy (CRT). The aim of this paper was to evaluate LA contractile function as a predictor of hospitalization for heart failure in a population after CRT.
Methods: Prospective, longitudinal study of 79 consecutive patients referred to CRT between October 2009 and April 2012. Median follow-up was 675 days (IQR 375 - 869). Clinical, demographic and analytical data were collected at the time of implantation. Standard echocardiography evaluation and 2D speckle tracking (2D-ST) longitudinal strain analysis were performed prior CRT. Left atrial contractile function was assessed with 2D-ST, as the early negative peak ε (P-waved timed analysis). The mean value of lateral, septal and roof ε was used. The prognostic performance was analyzed with receiver-operating characteristic (ROC) curve and cutoff values were calculated. The Kaplan-Meier methodology was used to assess event free survival.
Results: Mean age of the population was 65 ± 9 years, 63% were male and there was idiopathic etiology predominance (66%). The majority of the population was in NYHA class III (49 %). The mean basal QRS duration was 145 ± 30 ms and the mean left ventricle ejection fraction was 24 ± 7%. A threshold value of -0.57% of early negative ε had a sensitivity of 91.7%, and a specificity of 53.4%, to predict hospitalization for heart failure (AUC 0,682, $p < 0,05$). According to the proposed cut-off, patients with a LA early ε higher than $-0,57$% had more events on follow up (23.4 vs 3.1%, log rank $p < 0.05$).
Conclusions: In our population, LA early negative ε was predictor of hospitalization for heart failure after CRT

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Should reduction in left ventricular end-systolic volume be used to assess response to biventricular pacing?

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Introduction: A 15% reduction in left ventricular end-systolic volume (LVESV) following Cardiac Resynchronization Therapy (CRT) is commonly used to assess response to this therapy. However, controversy remains to whether this is the best parameter to predict outcomes in these patients
Purpose: To evaluate response to CRT by LVESV, and its impact in mortality. In addition, we aimed to assess prognostic impact of improvement in left ventricular ejection fraction (LVEF).
Methods: Prospective, longitudinal study of 79 consecutive patients undergoing CRT between October 2009 and April 2012 in a single center. We collected demographic, clinical and analytical data at the time of implantation and at follow-up. Standard echocardiographic evaluation was performed prior to and 6 months after device implantation. Response to CRT was defined as $\geq$15% reduction in LVESV. Primary endpoint was all-cause death at follow-up. Median follow-up time: 714 days (IQR 425-869 days).
Results: Mean age of population was $65 \pm 9,4$ years, 63% were male and 73% had idiopathic dilated cardiomyopathy. The majority were in NYHA class III. Mean basal QRS duration was $144,7 \pm 29,8$ ms. Following CRT, there was improvement in both LVESV ($169,5 \pm 80,1$ mL VS $141,7 \pm 83,5$ mL, $p \leq 0,001$) and LVEF ($24,5 \pm 7,1$% VS $32,6 \pm 10,1$%, $p \leq 0,001$). In Kaplan-Meyer analysis, response to CRT and any improvement in LVEF were associated with higher survival (logrank $p = 0,033$ and $p \leq 0,001$ respectively). In a Cox regression model, only any improvement in LVEF remained associated with higher survival [hazard ratio 0,09; 95% confidence interval 0,02-0,49; $p = 0,005$).
Conclusion: Response to CRT as assessed by left ventricular reverse remodeling was not associated with higher event free survival after adjustment for improvement in LVEF. Any improvement in LVEF was strongly associated with higher survival, suggesting that gain in contraction is more important than reverse remodeling for survival.

P279

Relation of QRS duration to left ventricular dyssynchrony in patients with dilated cardiomyopathy: tissue velocity and strain imaging study

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Background: One of the determining factors predicting the response and outcome of CRT is the presence of left ventricular dyssynchrony (LVD). The aim of this study was to detect the relation of QRS duration to the presence of LVD as determined by tissue velocity and strain imaging (TVI & SI respectively) in patients with DCM whether ischemic (IDCM) or non-ischemic (NIDCM).
Methods: we studied 60 pts (45 M and 15 F, mean age 55.7 $\pm$ 8.9 ys) with DCM, of whom 30 pts were diagnosed as NIDCM and 30 pts as IDCM. LVD was assessed from echo-Doppler by measuring septal to posterior wall delay (SPWD) & LV pre-ejection period (LVPEP). TVI and SI parameters of LVD were obtained by measuring time to peak systolic velocity (TSv) & time to peak systolic strain (TSε) in 12 LV segments with calculation of maximum delay of TSv or TSε between any 2 segments (TSv-max & TSε-max) and standard deviation of TSv or TSε in the 12 segments (TSv-SD & TSε-SD). Pts were classified into 3 groups according to QRS duration [G1: QRS $>$ 150 ms (8 pts), G2 QRS 120-150 ms (26 pts) & G3 QRS $<$ 120 ms (26 pts)].
Results: value of SPWD was higher in G1 (213 $\pm$ 71 ms) compared to either G2 (120 $\pm$ 56 ms) or G3 (118 $\pm$ 41 ms), p = 0.022 & p = 0.20 respectively, with no significant difference between G2 and G3, while values of LVPEP were higher in both G1 (164 $\pm$ 29 ms) and G2 (140 $\pm$ 35 ms) compared to G3 (118 $\pm$ 23 ms), $p < 0.005$ & $p < 0.01$ respectively with no significant difference between G1 and G2. Values of TSv-max & TSv-SD in G1 (111 $\pm$ 26 ms & 37 $\pm$ 8 ms) and in G2 (95 $\pm$ 39 ms & 34 $\pm$ 13 ms) indicated LVD according to the reference values in contrast to values in G3 (93 $\pm$ 47 & 31 $\pm$ 13 ms), the differences between the 3 group (G1 vs G2, G1 vs G3 or G2 vs G3) were not statistically significant. On the other hand, LVD parameters by SI (TSε-max & TSε-SD) were higher in G1 compared to G3 (310 $\pm$ 90 vs 205 $\pm$ 80 ms, p = 0.013 & 100 $\pm$ 36 vs 69 $\pm$ 25 ms, p = 0.04 respectively). The differences of SI parameters between G1 & G2 and between G2 & G3 were not significant. Patients with NIDCM had higher values of SPWD, LVPEP, TSv-SD, TSε-max & TSε-SD compared to pts with IDCM. There was a good correlation between SI parameters of LVD with the corresponding TVI parameters of LVD.Correlation between TSv-SD and TSε-SD revealed r = 0.71 ($p < 0.0001$) for the whole study group, r = 0.64 ($p < 0.0005$) in NIDCM pts and r = 0.79 ($p < 0.0001$) in IDCM pts.
Conclusions: LV dyssynchrony is more in patients with longer QRS duration. Patients with NIDCM have more LV dyssynchrony than those with IDCM. Strain imaging can better identify LV dyssynchrony than tissue velocity imaging.

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Three-dimensional trajectory of coronary sinus lead tip in CRT recipients: relations with left ventricular resynchronization

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Purpose: Cardiac resynchronization therapy (CRT) is an established treatment in heart failure (CHF), but the relations between left ventricular (LV) dynamics and LV intravenous pace are still a matter of investigation. We studied lead tip movements as a source of information about resynchronization of LV mechanics in CRT recipients.
Methods: Three-dimensional reconstruction of CS lead tip trajectory (3DtT) throughout the cardiac cycle by a novel fluoroscopy-based method was performed in 22 CHF patients (19 male, mean age 70 + 10 yrs) undergoing CRT. Three 3DtT were computed: just before (T-1) and immediately after (T0) biventricular pacing (BiV) start-up, and at 6-month follow-up (T1). CRT response was defined by the echocardiographic end-systolic volume reduction $\geq$ 15% at T1. 3DtT were compared between responders (R: 9pts) and non-responders (NR:13 pts) at T0,T-1 and T1.
Results: Variations of the ratio between 3DtT two main axes (S1/S2) and of 3DtT eccentricity were statistically different between R and NR, pointing out a change of the 3DtT towards a significantly more circular shape at BiV start-up in the R group. Most remarkably, R and NR could be completely separated by means of the percent variation of S1/S2 from T-1 to T0 (R: 47.5% [31.5% ÷ 54.1%] vs NR: -25.6% [-67% ÷ -6.5%]. This single marker computed at T0 could have predicted CRT response at T1.
Conclusions: Our preliminary data showed that modifications of 3DtT induced acutely by BiV were related to resynchronization and predicted volumetric response to CRT. The corresponding LV functional phenomena are still indeterminate.

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Is routine adjustment of pacing intervals after implantation worthwhile for response following cardiac resynchronisation therapy (CRT)?

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Introduction: A significant number of patients do not experience improvement following Cardiac Resynchronisation Therapy (CRT). Haemodynamically-guided adjustment of the intervals between paced chambers, ("optimisation" of Atrio-Ventricular (AV) and left-right ventricular (VV) delays,) may be undertaken to improve response to CRT. Evidence supporting this approach as standard is lacking, and many centres programme CRT devices to deliver "out-of-the-box" intervals, undertaking optimisation only when clinical response is lacking. We determine how often the "out-of-the-box" settings are optimal or acceptable, and how often CRT optimisation results in significant change to the preset intervals.
Methods: Data were collected from 180 consecutive patients who underwent CRT followed by optimisation within 24 hours. Optimisation was performed with serial adjustment of AV and VV intervals. Haemodynamic assessment was undertaken using either echocardiography or Non-Invasive Cardiac Output Measurement. Optimal pacing intervals were defined as those that most augmented cardiac output. These final settings were compared with the preset intervals for that device and the difference (AV or VV adjustment) derived. An AV or VV Adjustment of $>$40ms was considered clinically significant. Data are presented as mean (SD).
Results: Optimal AV delay ranged from 60 to 200ms (mean 124ms (30)), VV delay ranged from 0 to 100ms (mean 23ms (19)). Using preset pacing parameters, cardiac output was acutely augmented by 13.1 (34)%. Optimised CRT produced further improvement of cardiac output, to 24.9 (32)% augmentation. "Out-of-the-box" settings were found to be optimal in 11 (6.1%), or requiring only minor alteration in 120 (66.7%). A clinically significant alteration in AV delay was made in 40 (22.2%), in VV delay in 12 (6.7%) or in either parameter in 49 (27.2%).
Conclusions: Significant adjustment of AV or VV delay is required in over a quarter of patients receiving CRT. Optimisation of pacing intervals provides augmentation of cardiac output over and above the "out-of-the-box" settings. These findings suggest that optimisation is an worthwhile component of standard resynchronisation therapy.

Table 1. Adjustment of pacing intervals

Optimal Adjustment Time /ms	0	1-20	21-40	41-60	61-80	81-100
AV Adjustment /n (%)	29 (16.1)	89 (49.4)	22 (12.2)	32 (17.8)	7 (3.9)	1 (0.6)
VV Adjustment /n (%)	50 (27.6)	65 (35.9)	53 (29.3)	11 (6.1)	0 (0)	1 (0.6)

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Effectively delivered CRT using wireless endocardial pacing in previous CRT non-responder

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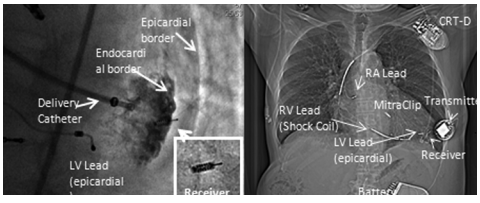
Introduction: CRT non-response remains an important issue. We report the case of a CRT non-responder who improves after implant of a wireless left ventricular endocardial cardiac stimulator.
Case Report: Four years ago a patient with symptomatic drug-refractory ischemic-based heart failure (HF) disease, NYHA class III, severe left ventricular dysfunction, and ventricular conduction delay with 130 msec duration QRS complex, underwent implantation of a atrio-biventricular implantable cardioverter defibrillator device (CRT-D) and then, due to worsening HF progression because of moderate mitral regurgitation, Mitra-clip device positioning in September 2009. Due to persistent severe symptoms (NYHA class IIII-IV), in May 2011 wireless cardiac stimulation system was placed to deliver CRT from the endocardium. This system, that functions in parallel to a pre-existing device (ICD) has three components: 1) the receiver endocardial electrode that ensures stimulation of the myocardium by converting ultrasound energy into electrical energy; 2) the transmitter which senses right ventricular activity and transmits a rapid ultrasound beam to the electrode; 3) the battery implanted subcutaneously in the abdominal wall (Figure). Six months after implant of the new device the patient improved to NYHA class II, had no HF-related hospitalization, and transthoracic echocardiogram revealed a clear recovery of lateral wall kinesia with LVEF improvement to 33%.
Conclusion: The present case shows how wireless endocardial lateral wall stimulation effectively delivered CRT in a patient in whom conventional transvenous epicardial stimulation previously failed. This novel technology may be a solution to address the problem of CRT non-response.



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Triventricular pacing in patients non responders to cardiac resynchronization

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Background: Patients with symptomatic heart failure despite a medical and electrical optimal treatment still have a very poor prognosis, and there is no validated therapy to improve their status.
Aim: To evaluate the impact of adding a second left ventricule lead to reach a triventricular pacing in patients non responders to a conventional cardiac resynchronization.
Method: We included patients with a previous CRT device, who were initially or secondarily non responders to this therapy, despite an effective rate of biventricular pacing up to 95%. A second left ventricular lead was implanted via the coronary sinus with an endovascular way. The two left ventricular lead were connected with an Y-adaptator. Patients implanted successfully were followed at 3, 6, 12, 24 months after the procedure. A positive response was defined as an NYHA class improvement, without hospitalization for heart failure. Device- related adverse events and electrical parameters of the left ventricular leads were also collected during the follow up.
Results: 19 patients were included, and 17 were implanted successfully of a second left ventricular lead. 75% were in class 3 NYHA and 15% a class 4. The only intra-operative complication noted was an hemopneumothorax. Medium follow up was 18 month. 2 patients presented a phrenic stimulation resulting in a triventricular pacing interruption. 2 patients presented an infection and the device had to be removed. We didn't note any re-intervention consequently to a left ventricular lead dysfunction and only one reintervention because of a defibrillator lead dysfunction. 8 patients died during the follow up, 6 from cardiac causes. After one year, 66% of alive patients had still an effective triventricular pacing, all the others had at least a biventricular effective pacing. 55% of the patients had a positive response to triventricular pacing. Left ventricular circuit impedance was lower than in conventional device, pacing thresholds didn't increase significantly during the follow up.
Conclusion: In our study, triventricular pacing is a feasible technique which leads to a clinical improvement in a half of these non responders patients with an acceptable rate of adverse events. Triventricular pacing can be an interesting perspective when heart transplant or assistance is not indicated.

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T peak-t end interval as a risk factor for ICD therapies in patients with arrhythmogenic right ventricular cardiomyopathy

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Purpose: The Tpeak-Tend (Tpe) interval is an electrocardiographic index of transmural repolarization dispersion and has been reported to predict life- threatening arrhythmias in the long QT syndrome, Brugada Syndrome, hypertrophic cardiomyopathy and systolic dysfunction. However it is not studied in patients with ARVC. We hypothesised that Tpe at the time of implant predict appropriate future therapy in patients with ARVC.
Methods: We evaluated 25 ARVC patients receiving an ICD for primary or secondary prevention from 2004-2010 with follow up at our center. (16 M, 42 $\pm$ 16 Y). Tpe was defined as the peak or nadir of T wave to the end of T wave and was measured in each precordial lead by a single blinded observer. Appropriate ICD therapy was defined as having VT/VF terminated by either anti-tachycardia pacing or shock during f/u. The f/u period was 63 + -29 months.
Results: Upon presentation, two patients had suffered aborted sudden death, eight syncope, and four presyncope. None of the patients had abnormal (>460 ms) QTc interval or QT dispersion. During f/u, nine patients experienced appropriate ICD therapies. Tpe were significantly prolonged in patients with ICD therapies versus patients without. (138.1 $\pm$ 30.1 ms vs. 114.5 $\pm$ 19.4 ms in V4; 145.7 $\pm$ 37.7 ms vs 112.4 $\pm$ 18.3 ms in V6, p = 0.029 and p = 0.008, respectively).
Conclusions: Our study demonstrates significant correlation between Tpe in V4 and V6 and occurrence of ICD therapies, suggesting that Tpe interval may be useful in risk stratification of patients with ARVC.

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ST segment depression during supraventricular tachycardia determined by VA intervals

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Purpose: Faster tachycardia rates during supraventricular arrhythmias are associated with high troponin levels. ST segment depression (STD) in supraventricular tachycardia has not been yet associated with shorter tachycardia cycle lengths (TCL). Our objective is to determine a possible mechanism explaining STD and its relation with the TCL.
Methods: Patients admitted for SVT ablation between 2010-2012 were analyzed (n = 55). AVNRT and AVRT were included. Exclusion criteria were: Bundle branch block; Ventricular repolarization anomalies; Associated arrhythmias; Coronary artery disease and Coronary risk factors. SVT measures were performed: QRS, ST, QT, T wave, TCL and VA interval length. Pseudo right bundle branch block pattern was also considered. ST segment depression was defined as >2mm from the J point in >2 consecutive leads. Different ST morphologies were analyzed: Ascendant STD (ASTD), Descendant STD (DSTD), and Horizontal STD (HSTD). Two groups were compared, those who developed STD (group A) and those who didn't (Group B).
Results: Median age 52 years (IQR 32-62,5); Males 41,82%; 80% AVNRT; 20% AVRT; 41,82% developed STD (39,13% ASTD, 21,74% DSTD, 39,13% HSTD); AVRT VA median 136ms (IQR 125-150) and TCL 344ms (IQR 317-401ms); AVNRT VA median 54ms (IQR 43-90) and TCL 345ms (IQR 303-377,5ms). Group A presented higher VA (median VA 115ms; IQR 63-136ms vs. 53ms; IQR 40-84; p = 0.015). No TCL differences were observed within both groups (334ms; IQR 305-376ms vs. 360ms; IQR 322-385,5; p = 0.67). Median VA and TCL in ASDT were 48ms (IQR 44-66ms) and 344ms (IQR 326-402ms) respectively; VA 124ms (IQR 114-124ms) and TCL 384ms (IQR 288-420ms) in DSTD; VA 142ms (IQR 126-146ms) and TCL 322ms (IQR 300-338ms) in HSTD; VA 48ms (IQR 44-66ms) and TCL 344ms (IQR 326-402ms) in Pseudo right bundle pattern. AVNRT developed STD in 35% of cases while 72.73% of AVRTs showed STD.
Conclusions: ST segment depression is conditioned by retrograde atrial activation during SVT. Retrograde P waves can distort ST segment depending on the VA interval length. This was observed at VA intervals >120ms, without depending on TCL. AVRT has higher STD rates, as VA intervals are longer than AVNRT. No TCL differences were observed between both groups, suggesting that STD is not rate dependent.

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Early repolization variant frequently detected in young adults in Algeria

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Background: Early repolarization variant (ERV) is considered to be a benign condition, but recently its presence has been related with a certain vulnerability to ventricular fibrillation in many case reports and case-control studies. The ERV was the subject of many studies in highly developed countries and its prevalence is estimated between 3.3 and 6.7%. ERV prevalence in the Maghrebian population is unknown. The aim of this study was to appreciate the prevalence of the ERV within a sample group of healthy Algerian young adults.
Methods: ERV prevalence was assessed within a sample group of 441 healthy male and female subjects (average age: 25 years old; age ranges: 18 to 36 years old) using 12-lead electrocardiography. Three independent cardiologists interpreted the ECGs and ERV was stratified according to the J-point elevation ($\geq$0.1 mV) in the inferior, apicolateral or both leads associated with QRS slurring or notching.
Results: The ERV pattern was found in 55 subjects (12.4%). A malignant ERV (>2mm) was discovered in 5 subjects (0.9%). Seventeen subjects (3.8%) presented the ERV pattern in the lateral leads, 16 (3.6%) in the inferior leads, and 22 (5%) in both lateral and inferior leads. Notch pattern was present in 14 subjects (3.2 %), slur pattern in 30 subjects (6,8 %), and a combination of the two patterns in 11 subjects (2.5%). The ERV pattern was more prevalent in males (15.6%) than in females (11.2%). The ERV prevalence was not higher among the youngest subjects. None of the participants experienced symptoms nor had a history of familial sudden death.
Conclusion: ERV is a common finding among a young healthy Algerian population. Its prevalence seems to be more important than in highly developed countries.

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The JT interval is inversely correlated with ventricular depolarisation time

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Introduction: The QT interval is a measure of the duration of ventricular depolarisation and repolarisation. Because the QT interval encompasses the ventricular depolarization period, it has been suggested that the JT interval better describes the time of ventricular repolarisation than the QT interval, particularly in cases with widened QRS complexes. In the present study we tested the hypothesis that duration of both, QT and JT interval may be related to the QRS complex width.
Methods: In 154 postinfarction patients (61 ± 10 years, 130 men) with ventricular premature beats (VPBs) on a standard ECG we compared the duration of QT and JT intervals in sinus beats and in VPBs, and assessed the relations between QRS complex width and JT interval length.
Results: The values of QT interval duration were greater in VPBs than in sinus beats, but surprisingly the JT intervals were shorter in VPBs than in sinus beats (Table).
Multiple regression analysis revealed the significant correlation between JT interval and RR interval of basic sinus rhythm (beta = 0.476, t = 6.753, p = 0.0001), and negative correlation between JT interval and QRS complex width (beta = −0.148, t = −2.109, p = 0.0366).
Conclusions: Widening of the QRS complex is associated with shortening of the JT interval. Different results of clinical studies may be obtained when JT interval is substituted for QT interval in patients with widened QRS complexes.

	Sinus beats*	VPBs	t -value	p-value
QRS complex (ms)	106 ± 22	151 ± 21	25.07	0.0001
QT interval (ms)	432 ± 47	466 ± 57	8.66	0.0001
JT interval (ms)	326 ± 47	315 ± 51	2.58	0.0107

* including 21 patients with complete bundle branch block; VPBs = ventricular premature beats

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Prevalence and clinical predictors of elevated electromagnetic QRS-fragmentation index in patients with acute myocardial infarction undergoing cardiac magnet field imaging

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Background: Magnet Field Imaging (MFI) is a non-invasive method to register cardiac electromagnetic activity. Early reports have suggested a positive predictive value of an elevated electromagnetic QRS fragmentation index for the occurrence of ventricular arrhythmias.
Aim of the study was to analyze patients with acute myocardial infarction (AMI) undergoing MFI investigation and to find independent predictors for an elevated electromagnetic QRS fragmentation.
Methods: A total of 344 consecutive patients with AMI underwent a MFI investigation between February 2011 and December 2012 and were analyzed. An electromagnetic QRS fragmentation index (eQFI) > 1.2 was defined as an increased eQFI.
Results: One hundred and seven patients (31%) presenting with AMI had an increased eQFI > 1.2. eQFI in acute ST-elevation myocardial infarction was not different to patients with acute Non-ST elevation myocardial infarction. Independent predictors for an elevated eQFI in patients with AMI were increased QRS width > 110ms, atrial fibrillation, low EF < 40% and the presence of non-sustained ventricular tachycardia during holter ECG.
Conclusions: About one third of patients presenting with AMI had an increased eQFI. Increased QRS width, low EF < 40%, atrial fibrillation and non-sustained ventricular tachycardia were independent predictors for an elevated eQFI in patients with AMI. Follow-up of patients is needed to determine the clinical relevance of eQFI in AMI.

	eQFI ≥ 1.2	eQFI < 1.2	p-value
Age (years)	65 (53 - 74)	62 (53 - 71)	0.36
Female	17%	25%	0.10
Acute STEMI	46%	48%	0.69
Ejection fraction < 40%	40%	24%	0.003
QRS width (ms)	105 (93 - 120)	90 (81 - 102)	< 0.0001
Prior myocardial infarction	13%	4.6%	0.005
Hypertension	83%	76%	0.15
Diabetes	37%	32%	0.38
Atrial fibrillation	18%	7%	0.001
Cardiogenic shock	6%	1.3%	0.03
Ventricular fibrillation	3.7%	2.5%	0.50

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Relation of the depression with proarrhythmogenic electrocardiographic parameters

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Aim: We investigated the relationship of the depression and proarrythmogenic ECG parameters in metabolic healty subjects.
Methods: A total of 2298 subjects with a mean age of 50 (age range 18 to 92) were interviewed. Subjects who had smoking habit, diabetes, hypertension, coronary artery disease, dyslipidemia, chronic obstructive pulmonary disease, cancer, chronic use of any drugs including antiplatelets, heavy drinkers, metabolic syndrome, ejection fraction <55%, creatinine >1.4 in men and >1.1 in women, abnormal liver function tests and an abnormal TSH were excluded in a in a stepwise manner. The diagnosis of current (one month) major depression was made according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. Standart 12 lead ECG recordings were made with a commercially available electrocardiography machine (Nihon Kohden, Japan) in 50 mm/sec velocity and 10 mV amplitude.
Results: Two hundred sixty-one participants (160 females (61%) and 101 males (39%) with a mean age of 40 ± 15) constituted the final metabolic healthy cohort. ECG parameters were compared to individuals with and without depression no statistical difference was determined between PR, QRS, QT and heart rate.The main caracteristics, blood pressure, laboratory and Ecg parameters of cohort are presented Tablo 1.
Conclusion: Pro arrhythmogenic ECG parameters of metabolically healthy and use any drug patients with depression was similar to individuals without depression.

	Depression	Control	P
Age	35 ± 12	41 ± 16	0.007
SBP	109 ± 12	113 ± 14	0.043
Glucose	94 ± 10	95 ± 14	0.019
Creatinin	0.7 ± 0.1	0.8 ± 0.2	<0.001
Htc	38 ± 7	39 ± 4	NS
PR	147 ± 22	143 ± 25	NS
QRS	91 ± 11	91 ± 13	NS
QTc	397 ± 16	400 ± 26	NS
Heart Rate	75 ± 12	71 ± 12	NS

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Detection of atrial electromechanical dysfunction in non-dipper pre-hypertensive patients

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Introduction: A relationship between atrial conduction time and hypertension was shown in previous studies. Increased atrial electromechanical intervals used to predict atrial fibrillation by measured tissue Doppler imaging (TDI). So we aimed to search if there was any association between the non-dipping status and atrial electromechanical intervals in pre-hypertensive patients.
Methods: Forty one non-dipper and 33 dipper pre-hypertensive subjects enrolled in the study. Smoking, diabetes mellitus, hypertension, using antihypertensive drugs, congestive heart failure, renal failure, myocardial infarction or cerebrovascular accident were exclusion criteria. Systolic and diastolic blood pressures were measured with a mercury sphygmomanometer. Twenty four hours blood pressure was measured with cuff-oscillometric method. All patients were evaluated by transthoracic echocardiography. Using TDI, atrial electromechanical coupling (PA) was measured from the lateral mitral annulus (PA lateral), septal mitral annulus (PA septum), and right ventricular tricuspid annulus (PA tricuspid).
Results: Systolic and diastolic blood pressures were significantly higher in subjects with non-dipper phenomenon than dipper ones at night. Twenty four hours average systolic and diastolic blood pressures were higher in non-dipper pre-hypertensive subjects, but this elevation was not significant. Left and right intraatrial (PA lateral-PA septum and PA septum-PA tricuspid) and interatrial (PA lateral-PA tricuspid) electromechanical coupling intervals were measured significantly higher in non-dipper pre-hypertensive patients (31.3 ± 3.9 vs 24.1 ± 2.3 P = 0.001; 19.5 ± 4.3 vs 13.8 ± 2.1, P = 0.001; and 11.4 ± 2.8 vs 8.8 ± 1.5, P = 0.001). Also interatrial electromechanical delay was negatively correlated with dipping levels.
Conclusion: This study showed that prolonged atrial electromechanical intervals were related non-dipper pattern in pre-hypertensive patients. Prolonged electromechanical intervals may be an early sign of subclinical atrial dysfunction and arrhythmias' in non-dipper pre-hypertensive patients.

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Microvolt T-wave alternation as predictor of ventricular tachyarrhythmic events in patients with nonischemic dilated cardiomyopathy and ICD

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The microvolt T-wave alternation (mTWA), an elecrocardiographic (ECG) index of ventricular repolarization, has been proposed as an non-invasive predictor of arrhythmic risk.
The aim of our work was to study ECG markers of myocardial electric instability: microvolt T-wave alternation (mTWA), QT interval dispersion (dispQT) and heart rate turbulence (HRT) for predicting ventricular tachyarrythmic events in patients with nonischemic dilated cardiomyopathy (niDCM) after implantation ICD devices.
Methods and results: The study included 32 patients with niDCM (aged 43,5 $\pm$ 9,21 years;15,6% female, NYHA class 3,09 $\pm$ 0,3; QRS 111 $\pm$ 30,5ms; LVEF 25,6 $\pm$ 3,9%; sinus rhythm) who had ICD (n = 15) and CRT-D (n = 17) devices. Patients were followed 397 $\pm$ 177 days (between visits 168 $\pm$ 50); there were 1 death and 19 ICD discharges. We analyzed ventricular ectopy by Holter ECG monitoring-24h (Oxford) and HRT (TO and TS), mTWA and dispQT by software Intecard-7 (Belarus) with 7min ECG-12 recording (5 min of rest and 2 min of exercise test 25Wt\m) during native conduction. Results were compared with telemetry ICD /CRT-D devices. Patients with ICD shocks (events VT/VF) had abnormal dispQT and positive mTWA (n = 17); pathological HRT detected in 7 patients. Markers of myocardial electrical instability (mTWA, dispQT) were determined also in 15 patients (HRT in 4 pts) without ICD discharges. Subgroup analysis showed that these indices (mTWA, TO, TS, QTd) were changed significantly ($p < 0{,}001$). After multivariate regression and ROC curve analysis, only indicator mTWA remained significance (mTWA $\geq$ 44mcV; S: 0,803; 95% AI: 0,586-1,00; p = 0,012) and was emerged as independent predictor of VT/VF events in patients with niDCM and ICD.
Conclusions: Positive marker mTWA was as an independent proarrhythmic predictor; identification of pathological mTWA $\geq$44 mcV in patients with niDCM and ICD require more proactive management.

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What is the necessary intermittent rhythm monitoring frequency required for reliable atrial fibrillation recurrence detection? Insights from continuously monitored patients using a robust probabilisti

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Purpose: Strategies for the detection of atrial fibrillation (AF) recurrence after therapeutic interventions for AF employ various intermittent rhythm monitoring durations (IRM) (24h, 7 days, 14 days, 30 days) and frequencies (number of IRM examinations per year). Although there is significant evidence in the literature that all IRM strategies will under detect AF recurrence in an unknown and inestimable number of patients, the optimal choice of IRM strategy (IRM frequency and duration) remains more or less arbitrary. In the present work, using a robust probabilistic approach we evaluate the necessary IRM frequency and duration required for reliable (>95% probability) detection of AF recurrence.
Methods: Rhythm histories of 647 patients (mean AF burden, 0.12 $\pm$ 0.22; median, 0.014; 687 patient-years) with implantable CM devices were reconstructed and analyzed. With the use of computationally intensive simulation, we evaluated the accuracy and reliability of IRM of various frequencies and durations on the probability of successful AF detection.
Results: The required IRM frequency for reliable (>95% probability) AF detection depends on the amount (AF burden, $p < 0.001$) and temporal aggregation (AF density, $p < 0.001$) of the AF recurrence as well as the duration of the IRM ($p < 0.001$). Reliable AF recurrence detection can be obtained with IRM however this requires much higher frequencies than currently recommended in the guidelines. Especially for paroxysmal AF (low burden, mid-to-high density) required higher IRM frequency than currently recommended (>12 24h, >5 7d, >4 14d, >2 30d IRM per year, $p < 0.0001$). Lower frequencies will under detect AF recurrence in an unknown percentage of patients and will introduce a significant bias in the evaluation of therapeutic interventions.
Conclusion: Reliable (>95% probability) AF recurrence detection requires a much higher IRM frequency than currently recommended. Current IRM frequency recommendations will under diagnose AF recurrence and thus misclassified an unknown proportion of patients as being AF free.

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Association of anabolic steroids and autonomic cardiovascular risk in athletes

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The aim of the present study was to investigate the autonomic and morphofunctional cardiac alterations on bodybuilders anabolic androgenic steroids (AAS) users. Forty-five male with 29.8 $\pm$ 0.5 years-old participated voluntarily of this study and were separated in three groups: sedentary subjects controls (SE, n = 15), bodybuilders AAS users (SU, n = 15) and AAS nonusers (SN, n = 15). We evaluated heart rate (HR), arterial pressure (AP), as well as linear and nonlinear parameters of HR variability (HRV) in resting and during the active postural maneuver and electrocardiographic (ECG) and echocardiographic data at rest. Athletes making abusive use of steroids presented elevated baseline levels of AP when confronted to AAS nonusers and sedentary. The HRV parameters for both linear and nonlinear demonstrated that the users group showed a higher sympathetic modulation and a lower parasympathetic modulation is resting in comparison of the others groups. After the orthostatic test, however, we noted a lesser response of HR and AP as well as the sympathetic modulation measured by means of spectral analysis and symbolic nonlinear dynamic in SU groups in relation to SN and SE groups. The left ventricular mass (LVM), as well as the LVM index and LV end-diastolic volume was higher in trained groups than sedentary group. Furthermore, the LVM, LVM index, the LV posterior wall thickness, the interventricular septal thickness and the thickness relative of LV in end-diastolic were significantly higher in the user group in relation to nonusers and sedentary. The corrected values of QT interval (cQT) and QT interval dispersion (cQTD) were higher in SU group in comparison to the sedentary. AAS users presented a shift of QRS electrical axis towards to the left in comparison to the non users and sedentary volunteers. Our results suggested that AAS users had a marked autonomic dysfunction, which may constitute an important mechanism linking AAS abuse to increased cardiovascular risk. In addition, the structural and functional alterations of the cardiac musculature resulting from the use of anabolic steroids, by direct and/or indirect effects could provoke and perpetuate cardiovascular diseases. Therefore, the increased cardiovascular risk associated to indiscriminate use of AAS could be ascribed at least partially to the cardiac autonomic dysfunction.

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Interruption of anabolic steroid treatment does not reverse the dysfunction caused on ventricular repolarization and autonomic cardiac system in rats

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Introduction: The illicit abuse of high-doses of anabolic androgenic steroids (AAS) has been attributed as a main cause of several cardiovascular disorders. Previous studies have been demonstrated that heart rate variability (HRV) may provide independent prognostic information on ventricular arrhythmias and regular exercise improvement HRV. In addition, arrhythmic events were described secondary to the intake of AAS.
Objectives: Thus, the objective of this study was to investigate the effects induced by chronic administration of nandrolone decanoate (ND) on HRV and QT interval and whether they are reversible.
Methods: Female Wistar rats received weekly 10 mg/Kg of DECA (n = 8) or vehicle (CONTROL, n = 7) for 8 weeks. During 9th to 14th week, none of groups received any type of drugs. A custom-made elastic cotton jacket with two pieces of rectangular platinum electrodes was used to acquire ECG before and after 8th and 14th weeks of protocol, in conscious state, in a lead close to DII, with prominent R wave peaks for HRV and QT interval measurements. Data were stored on a PC for offline processing. All recordings were conducted in a quiet environment during morning hours (07:00–11:00 h). The beat-to-beat R-R intervals were extracted from the ECG signal and the time- and frequency-domain analysis was performed. For spectral analysis two frequency bands were determined: low frequency (LF: 0.2–0.8 Hz), and high frequency (HF: 0.8–2.5 Hz). Power (in ms2) was estimated as the area under the spectrum within these frequencies ranges. A $p < 0.05$ was considered.
Results: SDNN (standard deviation of RR intervals), RMSSD (square root of the mean squared differences of successive RR intervals) and pNN5 (percentage of successive RR interval differences greater than 5 ms) were reduced in DECA compared to CONTROL after 8 and 14 weeks of protocol ($p < 0.01$). HF was significantly reduced while LF/HF ratio was increased in DECA compared to CONTROL groups on 8th and 14th weeks ($p < 0.05$). QT interval was longer in DECA compared to CONTROL group after 8 (Control: 57 $\pm$ 5.7 ms vs. DECA: 67 $\pm$ 7.9 ms) and 14 weeks (Control: 70.4 $\pm$ 5.2 ms vs. DECA: 77.1 $\pm$ 7.9 ms) of protocol ($p < 0.05$).
Conclusion: Supraphysiological doses of ND induces cardiac autonomic dysfunction and may create a substrate for inducing electrical disturbances, increasing the time of ventricular repolarization, in female rats. Key-words: anabolic androgenic steroids, regular exercise, heart rate variability, cardiac autonomic dysfunction

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Pregnancy in patients with Brugada Syndrome

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Background: Little is known about the risks and outcomes of pregnancy in women with Brugada syndrome (BS). We therefore evaluated pregnancy outcome in patients with BS.
Methods and results: A retrospective analysis was performed on all women with BS who were pregnant. One hundred four women with a total of 219 deliveries were included. There were 15 spontaneous abortions. One infant died suddenly during the night 3 months after birth. Six pregnant women reported to have suffered at least one syncope during the pregnancy. Of the 3 women who received an implantable cardioverter-defibrillator (ICD) previous to the pregnancy, none received ICD therapy. The 4 patients with previous aborted sudden cardiac death had no events during the pregnancy. Of the 21 patients with syncope outside the setting of the pregnancy, 18 were asymptomatic and 3 suffered from a recurrent syncope during the pregnancy. During the long term follow up (mean follow up of 71 ± 60,24 months), two women received appropriates shocks.
Conclusion: In this retrospective single center study, serious events were not more frequent during pregnancy and the peripartum period in women with BS. The occurrence of syncope during pregnancy was not associated to a worst outcome, neither during the peri and postpartum period nor during long term follow up. The reported rate of miscarriage and sudden infant death will require further studies to confirm or rule out its association with BS.

Patients (n)	104
Age (years)	43,3 +/- 12,9
Proband (n)	29 (27,8%)
Family history of SCD (n)	66 (63,4%)
First degree (n)	40
Asymptomatic (n)	60 (57,7%)
Previous syncope (n)	21 (19,2%)
Aborted SCD (n)	4
ICD implantation (n)	26 (25%)

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Heart rate: an important confounder in the assessment of left atrial volume

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Purpose: Left atrial (LA) volume is an important prognostic risk factor in atrial fibrillation (AF) management. Magnetic resonance imaging (MRI) is considered the gold standard to assess cardiac volumes. LA volume is routinely corrected for body surface. However, the influence of heart rate (HR) on LA volume is less well understood. This study investigates the influence of a relatively small change in HR on LA volumes.
Methods: MRI was performed on 13 sheep (weight-matched): 6 sheep during sinus rhythm with a mean HR of 76±9 beats per minute (bpm) (SR76 ± 9), and on 7 sheep during right atrial pacing at 90 bpm (AOO90). Short axis cine images, with an interslice gap of 3-4mm, were acquired of the LA. LA volume (total, body and appendage) at maximal (LAmax), minimal (LAmin) and precontraction (LApre) volume was calculated by the summation of disks method (ml). LA function was calculated by following formula: LA expansion index (LAexp): (LAmax–LAmin)/LAmin × 100, LA passive emptying fraction (LApas): (LAmax–LApre)/LAmax × 100, LA conduit fraction (LAcon): (LVstroke volume-total LA empyting vol)/LVstroke volume × 100, LA active emptying fraction (LAact): (LApre-LAmin)/LApre × 100.
Results: AOO90 resulted in significant lower LA volumes compared with SR76±9 bpm. There was no significant change in the ratio of LA body to total volume and the ratio of LAA to total volume (SR76 ± 9: 73.4 ± 2.4% vs 26.6 ± 2.4%, AOO 90: 73.3 ± 2.4% vs 26.6 ± 2.4%). Increase in HR altered most of the volume derived function parameters.
Conclusion: An increase in HR leads to a decrease of LA volume. This decrease is proportional for both the body of the LA and the LAA. Furthermore, an increase in HR augments LA expansion index and the active emptying fraction. There is a decrease of the conduit fraction. The effect of HR should be considered as an important confounder in the assessment of LA volume and volume derived parameters.

	LAmax	LApre	LAmin	LAexp	LApas	LAcon	LAact
SR 76 ± 9	50.5 ± 3.2	40.6 ± 2.6	37.6 ± 2.5	34.4 ± 12.4%	19.3 ± 7.5%	70.8 ± 9.0%	7.1 ± 1.6%
AOO 90	36.1 ± 1.9	27.0 ± 3.0	23.1 ± 2.4	57.2 ± 15.9%	25.5 ± 6.8%	56.9 ± 5.9%	13.8 ± 6.7 %
absolute difference	14.3	13.6	14.5	22.7%	6.2%	13.9%	6.7%
relative difference	28.5%	33.6%	38.6%	39.9%	24.3%	19.3%	48.6%
significance	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.05$	p = ns	$p < 0.01$	$p < 0.05$

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Circadian and Seasonal variations of cardiac arrest and ventricular arrhythmias in patients with arrhythmogenic right ventricular cardiomyopathy

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Purpose: Circadian and seasonal variations of sudden cardiac death (SCD) and ventricular arrhythmias in patients with arrhythogenic right ventricular cardiomyopathy (ARVC) have not been determined. The aim of the study was to explore the relationship of the incidence of SCD and appropriate implantable cardioverter defibrillator (ICD) therapy with circadian rhythm and seasonal variation in AVRC patients.
Methods: This retrospective study included 126 ARVC patients. 98 (78%) patients were forensic autopsy-proven ARVC deaths from the National Forensic Institute registry and 25 (20%) patients were ARVC survivors who received ICD and subsequent appropriate ICD therapy. All patients presented as SCD at the first clinical manifestation. The timing and date of all malignant events were analyzed.
Results: We analyzed 99 SCD events in the autopsy-proven ARVC deaths and 48 appropriate ICD therapy episodes (1.92 per patient) in ARVC survivors. Appropriate ICD therapy records showed a mean VT cycle length of 313+/- 40 msec, (range 204 - 400 msec). Circadian distribution analysis showed nocturnal peak ($P < 0.05$) in SCD events and appropriate ICD therapies. The seasonal peak was clustered predominantly in the summer ($P < 0.05$) in both groups.
Conclusion: The incidence of ventricular arrhythmia and SCD events in ARVC patient demonstrated marked circadian and seasonal variation. Nocturnal and summer time event peaks were found in both ARVC survivors and non-survivors. Majority of the malignant events were not related to daytime activities.

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